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THE ELECTRICAL INSPECTOR A TEACHER OF ELECTRICAL CONSTRUCTION.

Electrical inspectors are sometimes heard to complain that they are too often compelled to teach unskilled electricians how to do certain kinds of electrical work properly. They find that property owners and architects are often induced by the low figures at which such men are usually ready to undertake electrical construction to award contracts to men not fitted by previous training to do such work, and that thereafter the inspector has to spend time needed for other work in showing how the installation must be made in order to pass inspection. This sort of thing became so annoying in one of the cities of the West not long ago that the city electrician was led to insert a statement in the electrical inspection rules of the city to the effect that his department would not longer engage in teaching incompetent men how to do wiring. This stand seems entirely justified, as the inspector's duty is covered when he points out what the fault is, without explaining how it may be remedied.

Aside from the annoyance to electrical inspectors of such a condition as this, it is most unfortunate for the property owner. It may and does sometimes lead to much unnecessarily extra work having to be done and paid for, and to awkward delays in getting the installation into service. Moreover, work once done improperly and then remodeled is generally far inferior in most ways to work done right initially. The best remedy for the disorder is to require licenses of all men in responsible charge of electrical construction, these licenses being issued by the municipal inspection department after it has satisfied itself as to the proficiency of the applicants for them. Such a requirement exists in some cities; its general adoption has been suggested by us in previous issues. It is a measure needed for the protection of the public and in the interest of electrical contractors who are in the business to stay and who make a practice of doing only high-class work.

Some remarks on the subject by Mr. Victor H. Tousley are interesting in this connection. At the meeting of the Electric Club of Chicago last week, a report of which will be found on page 933 of this issue, he referred to this matter, and said that he considered it unfortunate that Chicago has no provision for requiring licenses. It is to be hoped that something in this direction may be accomplished in the near future, as it would be to the advantage of contractors, wiremen, inspectors and property owners.

POWER-PLANT LIGHTING DRAWINGS.

The demand for thorough work in every responsible power-plant design recently led a large engineering firm to standardize its lighting practice and prepare special drawings of lamp locations, conduit runs, situations of switch and outlet boxes, all superimposed upon the regular plans and cross-sections of the stations. There is nothing new, of course, in the preparation of special drawings showing the locations of outlets and conduits on ordinary building floor plans; but the foregoing practice represents a distinct advantage over the hit-or-miss methods of power-house illumination so often encountered in different parts of the country, and deserves general adoption.

The treatment of the problem from the draftsman's point of view is as simple as the preparation of separate plans showing the location of various systems of steam, air, oil and water piping in relation to the outlines of the important machine units, foundations, galleries, columns and floors. It is desirable to show these outlines in comparatively faint lines, while the wiring and lamps, switch boxes and outlets are shown either symbolically or magnified as the case may require, in their exact locations in the station building. The outlined portion of the building may be traced in thin lines from a standard group of plans and sections, the lighting system being added in heavy lines, preferably with a table of data showing the type of fixture and lamp, the voltage of each symbolized unit and the meaning of all symbols and abbreviations employed. Such drawings will naturally permit scaling in an approximate fashion, but the spacing of lighting units and the height of lamps above the working plane, as well as the color of the walls, may profitably be included on the sheets, so that any engineer can at a glance determine all the essential data of the installation without being obliged to measure and count the individual equipment units except where checking is required.

These drawings are proving of no small value in the installations where they have been applied; they facilitate ordering new equipment, save the time of executives interested in improving the efficiency of illumination, and furnish a means of record of each plant and substation which is not to be despised when the call comes for accurate answers to questions about the connected lighting load at the station and the effectiveness of the installation in detail. They insure that lamps will go into the proper places if suitably checked by the construction inspector, and may be supplemented by skeleton diagrams of switch and circuit operation to advantage in cases where complex arrangements of lamps are used. If such drawings include, finally, the addenda obtained from counts and tabulations of lamps of various sizes and perhaps the outlined results of foot-candle tests, they become data sheets of the highest technical value. The cost of preparing such drawings is not large if the outlines of the building and its main equipment are traced from the standards or master drawings referred to above, and there is no doubt that the use of this method will become general in cases where the treatment of lighting equipment is placed upon the same engineering basis as the other branches of auxiliary power-plant design.

PUBLIC POLICY.

Although public utilities in reality are the most democratic of commercial institutions, it is equally true that popular conception places them in the same category with "overbearing and merciless trusts." This state of mind on the part of the public is due first to the monopolistic feature, in response to the economic law, that public utilities are best and most economically conducted as monopolies; and secondly, to the neglect, on the part of the operating organization, to suitably express in acts and words the true democracy of public utilities.

That public utilities should have a monopoly in the territories in which they serve is an unquestioned fact.

That public utilities, through their operating departments, should neglect to suitably express in acts and words their true democracy is a condition that, although it exists, is rapidly being remedied. It is a subject that has been frequently discussed but cannot be emphasized too strongly.

From time to time all companies must meet questions regarding their franchises, rates, extensions, improvements, character of service, etc. Sometimes the question is decided by a state commission or city council; sometimes by a court, and not infrequently by the people themselves at a popular election. In the final settlement of all of its issues the standing of the company with the people is the predominant factor. The fate of the real points involved in the controversies depends greatly on the feeling of the public for or against the corporation. Often logic and facts are of little service against an inflamed public sentiment. The prejudice created by real or fancied ill-treatment by a corporation at times is stronger than individual financial consideration and sometimes a public has decided against propositions which it knew to be in its interests.

These conditions being true, it is incumbent on public-utility companies to secure, in the greatest possible degree, the friendship of the public. Practices common to mercantile and other retail establishments are not always suited to the usage of lighting and power companies. A utility concern must take a much broader view of the manner of handling the various transactions between its customers and itself. Also, much depends upon the manager himself. In the words of Mr. W. H. Hodge, of H. M. Byllesby & Company, the manager of a public-utility company in a sense occupies a position with reference to the public somewhat similar to that of the office of

mayor. He has a varied constituency and he should endeavor as much as possible to come in contact with all the people and to obtain a sympathetic point of view. An atmosphere of exclusiveness about the manager is bound to result to his company's detriment. His door must be open to anyone who is convinced that he must see him. It is of untold benefit to his organization if it is known that he is accessible to the rich and poor alike, and that any person, regardless of age, appearance, nativity or affluence, may come to his office with absolute confidence that he will obtain a square deal in a pleasant way."

FOR AN ELECTRICAL CHRISTMAS.

With the approach of the Christmas season electrical manufacturers are again inaugurating elaborate campaigns for the sale of electrical devices suitable as gifts, with the idea of improving, if possible, upon the excellent record made last year.

Central stations, contractors and dealers, no matter how remotely located, can derive benefit from this activity by doing their part in focusing public attention on electrical merchandise. Central stations have, in previous years, obtained excellent results by attaching suitable advertisements to monthly bills; newspaper space, timely window displays and literature, which can be obtained from the manufacturers, also are productive of increased holiday business. Contractors also can benefit by adopting progressive methods. If window displays are neglected during the rest of the year, surely a change could be made for the Christmas season. Replace fans, switches, etc., with electrical toys, cooking devices, portable lamps, etc. Increased business can also be obtained from the sale and installation of electrical Christmas-tree outfits, which are so superior to candles from the standpoint of fire hazard.

If central stations, contractors and manufacturers will unite in a co-operative movement to stimulate the sale of electrical goods there is no reason why the electrical industry cannot receive its share of the stimulated business which the holiday season brings.

ACCOUNTING FOR CONTRACTORS.

That there is quite often a very deplorable lack of system and correct method in the management of the electrical contractor's office is a fact generally recognized by contractors who have had any considerable opportunity to investigate existing conditions. A reason for this is, oftener than not, that the contractor's training prior to the time of going into business for himself has not been of a character to equip him for the management of an office or the proper keeping of accounts; his experience has usually been along the lines of electrical construction rather than along those of efficient business routine. Certain contractors who have studied the matter have concluded that the best remedy—if not indeed the only effective remedy—for the defect mentioned is to place within the reach of the contractor who needs it, a system of keeping accounts adapted to the requirements of the business and, at the same time, simple enough to be easily understood without much previous knowledge of book-keeping.

Some time ago a movement was set on foot among the electrical contractors of Illinois to find or to develop such a system as the above. The system which was finally recommended was the one which Mr. F. L. Decker has described in this journal, the final installment appearing elsewhere in this issue. It seems that this system is admirably suited to the purpose for which it is intended. The number of forms involved does not appear to be greater than actually necessary, and they are so arranged that it is an easy matter to understand the correct method of making all entries and of carrying quantities from one sheet to another. This is probably the first time so complete a system of accounting for contractors has been published. There is certainly a great deal to recommend the adoption of these methods by contractors generally.

A NOTABLE EXAMPLE OF WELFARE WORK.

Upon another page of this issue will be found a statement of the new plans which have been announced by the American Telephone & Telegraph Company, the Western Union Telegraph Company and the allied Bell telephone companies for a system of old-age pensions, life insurance and disability annuities for employees. A large fund has been set aside from the surplus of the American Telephone & Telegraph Company to provide for the payment of these benefits, which are estimated to exceed by $1,000,000 per annum the present payments on this account.

Provisions of this nature for preventing destitution among superannuated employees and those who through accident or sickness are prevented from continuing their daily work tend to make employees more satisfied with their conditions and relieve them from the anxiety of looking forward to a condition of want in those cases where wages do not exceed living expenses by an amount sufficient to lay by some provision for old age. It also tends toward greater efficiency in the service by providing for the replacement of such employees as have become through advanced age unable to carry on their duties with the energy and alacrity necessary for the highest efficiency.

Action of this nature is becoming more common than it was a few years ago among the large corporations, and it is not at all surprising to find a man of the caliber of Theodore N. Vail, who is president of the American Telephone & Telegraph Company, taking a leading part in such a movement, for it is understood that the present action is the result of that gentleman's initiative. A policy of this kind is farseeing and far-reaching. Its benefits are not confined to the employees who are recipients of the fund. It makes for good feeling and illustrates that some large corporations, especially where headed by broad-minded men, are not entirely soulless, as so many have believed.

Annual Banquet of Commonwealth Edison Section, N. E. L. A.

The fifth annual banquet of the Commonwealth Edison Section, National Electric Light Association, was held at the Hotel Sherman, Chicago, November 7. As is characteristic of all meetings of the Chicago organization, a large percentage of the Section's 1,700 members were on hand and the usual spirit of good fellowship reigned. The banquet was enlivened by music, appropriate verses regarding retiring and incoming officers being sung.

Before a recess was taken to prepare the banquet hall for the entertainment which followed, Chairman R. F. Schuchardt called upon Samuel Insull, president of the company to make a few remarks. Mr. Insull was given a great ovation by the members and it was several minutes before he was able to speak. In response to this demonstration Mr. Insull said that as years go by he finds himself looking forward with increasing feeling to the reception which his co-workers accord him. Continuing he said that the greatest privilege he has is to talk to his own people and he urged that all members of the company take advantage of the opportunities that confront them. Special emphasis was laid on the advisability of saving money, "particularly in view of the results of the recent presidential election." The Edison savings fund offers employees practically 25 per cent on their money.

Before starting the program of entertainment Mr. Schuchardt made a brief address in which he thanked the members and the various committees for their assistance during his administration. He urged that increasing effort be extended during the coming year and anticipated a very successful administration for the new officers.

W. L. Abbott, the incoming president told briefly of his plans for obtaining greater co-operation among the members. He expressed feelingly his appreciation of the honor conferred upon him. The other officers who will serve with Mr. Abbott during the year are: C. A. Lind, vice-president; Milton Rich, secretary; and William A. Fox, treasurer.

The Commonwealth Edison Orchestra under the leadership of M. L. Eastman, was much in evidence during the evening. A concert was given in the lobby of the hotel, preceding the banquet and during the vaudeville entertainment a number of popular and clasical selections were given.

The Entertainment Committee having the banquet in charge was composed of the following: W. L. Abbott, chairman, N. A. Rollins, M. L. Eastman, G. H. Jones, F. H. Boldenweck, D. H. Howard, publicity, and J. T. Mountain, in charge of tickets and seating arrangements.

Properties of the Pacific Gas & Electric Company.

The first meeting of the Section, under the new administration, was held in Association Hall, 19 South LaSalle Street, Chicago, on Friday, November 8. John A. Britton, vice-president and manager of the Pacific Gas & Electric Company spoke very interestingly on the development and equipment of his company, which has for some time been known as one of the most progressive central stations in the United States.

After speaking briefly on the gas properties and the process of obtaining gas from oils native to California, Mr. Britton followed out the progress that had been made on the Coast in the way of high-tension transmission systems and hydroelectric developments. The Pacific Gas & Electric Company, it will be remembered, has in operation the longest high-tension transmission line in the world, the power from De Salba plant being transmitted 288 miles at 60,000 volts to the Electra mines. Practically all of the power of the company is available at any point, as the 12 generating stations are operated in parallel.

Mr. Britton showed a large number of lantern slides which gave an excellent idea of the conditions which prevail in the mountains at all seasons. He explained that some of the storage reservoirs at present in use were built not primarily for hydroelectric power, but for hydraulic mining which was formerly very extensively done in California, but was several years ago prohibited by an act of legislature. The Folsam power dam which was built in 1884 was in 1895 turned to the generating of electric power and was the first hydroelectric installation in the United States.

The Colgate plant, which the speaker mentioned as being the father of the system of plants owned by the Pacific Gas & Electric Company was finished in 1889 to transmit power to Sacramento, Cal., a distance of 78 miles, and in 1899 was used to furnish power to the street-car system of Oakland. This claims interest as having been the first 30,000-volt line in the United States. Prior to that time a potential of only 11,000 volts had been used.

Several pictures were shown of the Electra plant, which is the largest one of the system, generating 20,000 kilowatts. There are at that station five 2,000-kilowatt turbines and two 5,000-kilowatt machines. Mention was also made of the Placer County development, the reservoir of which will contain 30,000,000,000 cubic feet of water. This water will flow through a tunnel over 4,500 feet long, the capacity being 400 second-feet. A concrete tunnel eight and one-half miles in length, will carry this water over the mountains to the De Salba plant. There will at this point be a fall of 1,375 feet allowing for the development of 60,000 horsepower at Bear River. The three plants to be built in the Placer County development will have a total capacity of 125,000 horsepower.

The many stereopticon views shown by Mr. Britton, and the numerous interesting facts which he brought out, made the meeting a very interesting one.

Heating Convention for 1913.

The Executive Committee of the National District Heating Association, consisting of R. D. DeWolf, J. F. Lewis, J. L. Hecht, E. Darrow, D. L. Gaskill, A. D. Spencer, W. A. Wolls, and H. R. Wetherell, met in Indianapolis, Ind., on October 30 and 31. The object of the meeting was to arrange the program for the fifth annual convention and to fix the time and place for holding that convention in 1913.

After considering invitations from Washington, D. C.; Baltimore, Md.; Niagara Falls, N. Y.; Chicago, Ill., and other cities, the committee unanimously selected Indianapolis, Ind., and fixed the time on May 27, 28 and 29, 1913, with headquarters at the Claypool Hotel.

Papers upon the following subjects were arranged for: District Heating on the Pacific Coast, Possibilities of Hot-Water Heating, Line Condensation in Different Forms of Construction, Results of Using Bleeder Turbines, Appraisal of Heating Properties, Station Designs with Special Reference to Overload Capacities, Uses and Abuses of Public Service Commissions, Hot-Water Heating for Residence Districts, Public Policy, and two others, to be announced at a later date.

In addition, reports were asked for from standing committees on Meters, Station Records and Rates. The report of the Committee on Meters to call for experience of those stations that have changed over from flat rate to meter rate.

Peoria Show.

The second annual electrical show of the Peoria Show Association will be held in the Coliseum, Peoria, Ill., January 18 to 25, 1913.

That Peoria is a good town for obtaining support for a show has been demonstrated by the recent "Home-Products Show," which was held in the Coliseum at that place. This was attended by about 30,000 persons.

Reorganization of the International Photometric Commission.

The International Photometric Commission, commonly known as the "Zürich Commission," was created by the International Congress of Gas Industries which convened in Paris in 1900. This commission, composed of representatives from the various national technical gas societies with the co-operation of certain of the national laboratories, has been concerned with general questions of photometry in addition to its more specific functions in connection with the photometry of the incandescent mantle.

Inasmuch as there has developed a widespread appreciation of the need of an international; thoroughly representative commission to deal with general questions of photometry, and possibly also of illumination, it has been proposed that the International Photometric Commission be reorganized to fulfill these requirements in a way acceptable to all photometric interests. This movement is being well received both in Europe and America.

President Vautier, of the International Photometric Commission has requested the Sub-Commission on Photometric Units and Standards to formulate a plan of reorganization. This sub-commission was originally appointed at the 1911 session of the International Photometric Commission to consider the recommendations of the Illuminating Engineering Society (U. S.) regarding photometric nomenclature and standards. The Sub-Commission at present is composed of the following members: Dr. Brodhun, Dr. Kusminsky, M. Laporte, Mr. Paterson, secretary, M. Vautier, ex-officio, and a representative of the United States soon to be appointed. The personnel of the sub-commission, composed of representatives of the various national laboratories, is peculiarly qualified to undertake the duty of formulating plans of reorganization. It is hoped that as the outcome of the efforts of the sub-commission, with the endorsement of the various national technical gas societies to which the International Photometric Commission in the past has been responsible, an essentially new commission will be formed which will be equally representative of and responsible to all national technical gas, electric and illuminating engineering societies, and other bodies interested in photometry and illumination.

L. O. Ripley.

L. O. Ripley, president of the Kansas Gas, Water, Electric Light and Street Railway Association, has been devoted to the development of electric lighting and power enterprises since he was knee high. His experience covers not only the managerial and executive details, but embraces also the practical work of the design and construction of central-station plants.

Mr. Ripley began as a boy working and hanging about electric light plants, and during his high-school course was employed with more or less regularity in this class of work. He entered Union College in the electrical engineering course, and graduated with the class of 1900. Immediately following this he went out on construction work on central stations, and also devoted a good deal of time to storage-battery work. He continued in this way for about three years, after which he returned to his college town of Schenectady and entered the employ of the Schenectady Railway Company as superintendent of the lighting and power department. He remained with this company until the local and interurban systems of the Schenectady Railway Company were sold to the New York Central Railroad and the Delaware & Hudson Company. This transfer necessitated the divorcing of the electric lighting business from the property of the Schenectady Railway Company. He assisted in this turnover, and was made manager of the Schenectady Illuminating Company when the change was complete.

L. O. Ripley,
President, Kansas Gas, Water, Electric Light and Street Railway Association.

Mr. Ripley remained with the Schenectady Illuminating Company as manager until about three years ago, when he became associated with the American Power & Light Company, New York, and went to Kansas in the capacity of vice-president and general manager of the property of the Kansas Gas & Electric Company, which at present includes the gas and electric business in the cities of Wichita and Pittsburg, Kans., and the electric business of the cities of Independence, Newton and Cherryvale, including some other small towns in the outlying district.

Mr. Ripley has been a prominent figure in connection with the state and national associations devoted to the central-station business, and is an associate member of the American Institute of Electrical Engineers.

Central Electric Program.

The program for the November meeting of the Central Electric Railway Association, which will be held at Columbus, O., Thursday, November 21, includes the following papers: "The Interurbans, Retrospective and Perspective," by Gaylord Thompson, chief engineer of the Ohio Electric Railway, of Springfield, O.; "Interline Travel," by J. F. Starkey, general passenger agent of the Lake Shore Electric Railway, of Sandusky, O., and "Claim Index Bureau," by William Tichenor, claim agent for the Terre Haute, Indianapolis & Eastern Traction Company. The papers will be followed by discussions. In addition to the papers and discussions there will be reports by committees and transaction of routine business. A meeting of the Central Electric Traffic Association will be held November 20, at Columbus, O., and on the evening of the same day there will be a meeting of the executive board of the Central Electric Railway Association.

Electric Sign in Montevideo.

The first large electric changing display sign in Uruguay was recently installed in Montevideo. It has a capacity of 40 advertisements, each visible every seven minutes. Its cost, after being placed in position, amounted to $6,100.

Bell Plan for Pensions and Insurance.

A fund of $10,000,000 for pensions, sick benefits and life insurance will be available on January 1, for the 175,000 employees of the Bell system and associated interests, and their families and dependents, amounting altogether to more than a quarter of a million people. This $10,000,000 fund will be made good from year to year by annual appropriations on the part of the American Telephone and Telegraph Company and associated companies, the Western Union Telegraph Company and the Western Electric Company.

The plan for the distribution of the fund has been characterized as the most liberal, comprehensive and ideal ever inaugurated. President T. N. Vail has provided combined benefits for superannuation, sickness, accident and death, for an industrial army more than twice as large as the standing army of the United States. This provision is made entirely at the expense of the various companies interested, without contributions of any kind from the employees themselves. The application of these varied benefits will be strictly democratic and will be for the benefit of all employees of every rank. The plan will provide for free change of employment from one company to another, with full credit for combined terms of service.

The Bell system and associated interests provide employment for about 175,000 people; of this number 130,000 are employees of the Bell telephone system. The total yearly pay for the whole group is about $115,000,000, something over $80,000,000 being paid out in wages by the Bell telephone system alone.

The terms by which provision is made for the needs of age, illness, accidents and death, may be summarized as follows.

Pensions.

Male employees who have reached the age of 60 years and who have been 20 years or more in service, may retire on pensions. They may be retired at the option of the company when they have reached the age of 55 years and have been 25 years or more in service. The pension age of female employees is in each case five years less than that of male employees. Any employee who has been 30 years in service, regardless of age, may be pensioned on the approval of the president of the company.

The amount of the pension is based on the years of service and the amount of pay, and will be one per cent of the average annual pay for ten years, multiplied by the number of years of service. Therefore, a man who had been thirty years in service would get 30 per cent of the average salary which he had been receiving during his last ten years of service. No pension will b less than $20 a month.

Accident Disability Benefits.

In the case of accidents occurring in and due to the performance of work for the company, the employee will receive full pay for 13 weeks, and half pay for the remaining time of disability, up to six years.

Sickness Disability Benefits.

Employees who are disabled by sickness or accident outside of the regular course of duty after ten years or more in service, will receive full pay for 13 weeks and half pay for 39 weeks; if from five to ten years in service, full pay for 13 weeks and half pay for 13 weeks; if from two to five years in service, full pay for four weeks and half pay for nine weeks. In the case of employees who have not been two years in service, heads of departments will be permitted the same discretion as heretofore, in continuing pay during temporary illness.

Life Insurance.

In the case of death resulting from accident in and due to performance of work for the company, an insurance amounting to three years' pay, will be paid to the dependents of the employee, the maximum payment being $5,000.

In the case of death resulting from sickness or from accident outside the business, the payment will be one year's pay for employees who have been ten years or more in service, and one-half of one year's pay for employees who have been from five to ten years in service, the maximum payment being $2,000.

If any state statutes provide for more liberal compensation than is provided in the benefit plan, the statutory provision will prevail. Where the employees have rights, as in some accident cases, they will have the option of exercising such rights or accepting the company's benefits.

The American Telephone and Telegraph Company has set aside from its surplus a fund which provides for those whom it directly employs, and also provides a reserve, upon which, under certain conditions, the associated companies may draw. This fund is supplemented by funds set aside by each company. The total appropriations will aggregate something more than $10,000,000. The benefits, it is estimated, cost annually about $1,000,000 more than the present payments on this account.

The administration of the funds will be in the hands of employees' benefit committees of five, to be appointed by the board of directors of each company. The committee of each associated company will have jurisdiction over the benefits for employees of that company.

The Employees' Benefit Committee of the American Telephone and Telegraph Company will have general jurisdiction over the plan for the entire system and specific authority as to the American Telephone and Telegraph Company's employees' benefits.

Meeting of Electrical Manufacturers' Club.

The annual meeting of the Electrical Manufacturers' Club was held at the Homestead Hotel, Hot Springs, Va., November 6 to 9. Officers were elected as follows: president, S. O. Richardson; vice-president, J. E. Way; secretary, Walter Cory; treasurer, H. A. Sinclair; commissary and master of transportation, Charles I. Hills.

B. M. Downs presided at all the meetings, and on Friday evening in a delightful and graceful introduction presented Charles W. Eliot, president emeritius of Harvard University, who delivered a notable address on "The Fortunate and Happy Conditions of Labor."

During the week addresses were also made by J. Robert Crouse, F. E. Watts, Jupiter of the Jovian Order, and W. H. Merrill. The latter is manager of the Underwriters' Laboratories, of Chicago, and New York. He explained the functions of the laboratories and made answer to a number of questions.

About 45 members of the club attended the meeting, and a number of guests enjoyed the hospitalities of the club. In the golf contests the winners were J. W. Perry and Walter Cary.

Radio Engineers Meet.

The November meeting of the Institute of Radio Engineers was held at Columbia University, New York City, on November 6. Lee deForest gave a detailed description of the operations of the Federal Telegraph Company on the Pacific Coast. This concern is building instruments under the Poulsen patents, but of designs better fitted for hard service than are those of the Danish company. The antenna and tower construction, the arc transmitter and receiver, and the diplex transmission made possible by use of a high-speed commutator were discussed.

The Institute is to begin publication of *Proceedings* during the current month, printing in the first issue a paper by M. I. Pupin on the variation with frequency of antenna resistance. The Committee on Standardization reported satisfactory progress in the classification of nomenclature, having met weekly since the middle of September.

Electricity in Stove Manufacturing.

Figures on comparative operating costs of stove-manufacturing plants show that a considerable saving can be effected by purchasing power. If steam operation is employed the many advantages of motor drive are equally as important as the actual saving in power costs that can be shown. Data on several plants are given in this article.

The processes involved in the manufacture of stoves and ranges can be grouped under four classifications, each in itself a separate industry: (1) foundry; (2) machine shop; (3) pattern shop, and (4) electro-plating. Electro-plating and pattern making constitute only a very small portion of the work involved, however, the foundry and machine-shop operations forming the bulk of the work.

In the foundry the most important point to consider is the operation of the cupola. The problem of providing a proper supply of air for the operation of a foundry cupola is in many respects similar to the problem of providing a proper supply of air to a blast furnace. The blast furnace requires much larger volumes of air, and under more arduous conditions, since its operation is continuous for many months; whereas the foundry cupola is in operation only through a few hours each day. The latter, therefore, is not subject to the great variations in conditions of operation which occur in blast furnaces due to this long continuous operation, and, moreover, operates under improved conditions owing to the differences between the physical characteristics of the charge of pig iron, as compared with the physical characteristics of the ores which are charged in the blast furnace. Therefore, the blast conditions in the cupola are much more uniform than they are in the blast furnace and the requirements for properly operating a cupola under all conditions can be met by apparatus which produces practically a constant pressure; whereas, in the blast-furnace apparatus, constant volume is the prime requisite, and apparatus must be provided capable of working under a considerable range of pressures in order to meet the fluctuating conditions encountered in the operation of the furnace.

Centrifugal compressors have been used for some five or six years in England and on the continent, consisting generally of one or more rotating impellers in series, taking air at atmospheric pressure and compressing it to pressures required for the service of the blast furnace, that is to say, 12 to 15 pounds average pressure, and 25 to 30 pounds maximum, with provision for passing air at a constant rate; but no machines of the type mentioned were put on a blast furnace in this country previous to March, 1910, when the first was put in service at the Oxford Furnace of the Empire Steel & Iron Company, at Oxford, N. J. This apparatus has been found to be excellently adapted for the requirements of blast-furnace blowing, and a

Group of Tumbling Mills Driven by Motor.

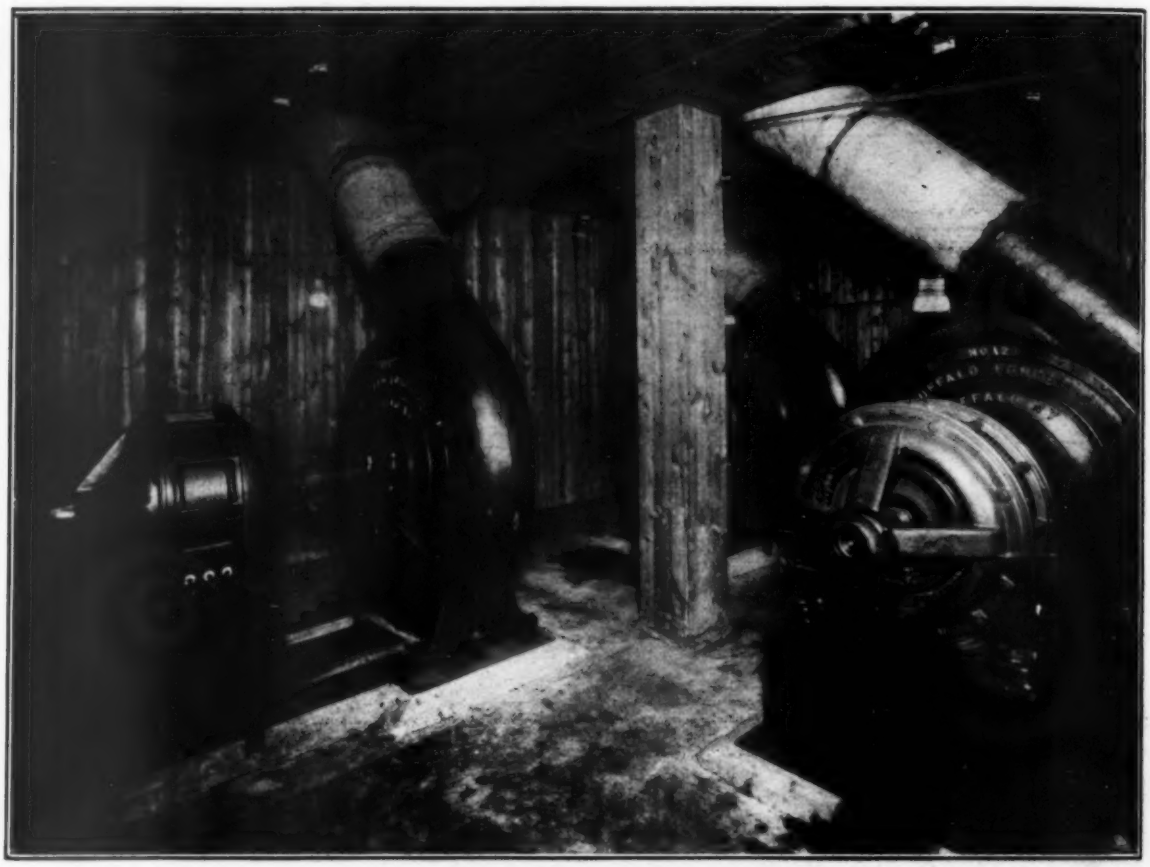
number of machines of various capacities are under construction for similar situations as a result of the good performance of these first machines. Similarly with regard to cupola work in the iron foundry, it has been found that this type of apparatus is perfectly adapted for use in connection with a furnace for melting iron; and the same reasons which render it suitable for blast-furnace service are also found to apply in the case of the cupola.

One of the important points in connection with this apparatus, which is of benefit in cupola work, is the extreme steadiness of the blast. The steady melting of iron and the steady descent of the charge from the cupola are dependent on the maintenance of uniform conditions of air pressure, because the charge in the cupola is, to some extent, supported by the pressure of the blast; so that if this pressure varies, the charge is likely to descend in a more or less irregular manner, causing an irregular, unsatisfactory working of the cupola. The uniform, steady blast produced by the centrifugal compressor, therefore, produces more uniform, steady conditions of melting.

Another point which is of importance in this connection, is the high efficiency of the centrifugal compressor, and the maintained efficiency after long periods of service. This efficiency is due to improvements made in the design of the apparatus, as compared with the centrifugal fans which have often been used for this purpose, and which are, by comparison, very wasteful in power absorbed. In the case of the centrifugal compressor, the velocity impressed on the air by the movements of the impeller, is changed into pressure by the gradual slowing down of the air; and the fundamental principle which is responsible for this improvement in efficiency, and which has been observed, is that the slowing down of the air must be done in a perfectly definite manner, and without the production of any eddies.

Data on the ordinary high-pressure exhaust fans, designed for cupola work, are given in the accompanying tables, together with the power requirements of casting rattlers, grinders, emery wheels, etc.

Conditions as found in the typical steam-driven stove manufacturing plant with recommendations for modernizing methods of operation, are illustrated in the following notes taken from a proposition submitted by a central-station company to a stove plant. The establishment in question, located in Louisville, Ky., maintained a steam plant, transmitting power to all departments by belts and shafting. Indicator tests on the engine showed the friction load to be 23 horsepower. The coal consumption for carrying this load alone was 1,380 pounds, which, at a rate of $1.35 per ton, amounts to $0.93 per day, or $22.32 per month. This amount practically represents the saving effected by the substitution of motor drive, but in addition, records show the production to have been increased 13 per cent. Motors aggregating 85.5 horsepower were installed as follows:



Motors Direct-Connected to Cupola Blowers.

Shipping Department. Three-horsepower motor running at a speed of 1,800 revolutions per minute is belted direct to 12-inch double emery wheel; motor pulley 4 inches, emery pulley 6 inches; speed of emery 1,200 revolutions per minute; motor is hung from ceiling. Two-horsepower motor, speed 1,800 revolutions per minute, hung from ceiling and belted direct to swing saw.

Finishing Department. Seven three-horsepower motors, speed 1,800 revolu-

TABLE I.
DATA ON HIGH-PRESSURE EXHAUST FANS.
(Type P, American Blower Co.)

No. of Fan.	Dia. of Wheel.	Width of Periphery.	Blast Area Sq. Ft.	Dia. Outlet Inside.	Area of Outlet Sq. Ft.	Cir. of Wheel in Ft.		Pressure in Ounces.											
								2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
3	19.5	1.875	0.1033	7.25	0.2866	5.10	r.p.m.	1580	1936	2235	2510	2735	2960	3160	3355	3540	....	....	....	....	....	....
							cu. ft.	926	1135	1310	1460	1600	1735	1845	1960	2070	....	....	....	....	....	....
							hp.	1.015	1.86	2.88	4.0	5.25	6.63	8.05	9.62	11.3	....	....	....	....	....	....
4	22	2.125	0.132	8	0.349	5.76	r.p.m.	1400	1750	1980	2215	2420	2620	2800	2970	3130	3280	3430	3535	....	....	....
							cu. ft.	1128	1380	1590	1780	1945	2110	2250	2385	2520	2640	2760	2840	....	....	....
							hp.	1.23	2.26	3.47	4.86	6.38	8.06	9.85	12.2	13.8	15.8	18.0	20.2	....	....	....
5	24.5	2.375	0.164	9	0.442	6.40	r.p.m.	1260	1545	1780	1990	2180	2360	2520	2670	2820	2950	3080	3175	3335	3450	3570
							cu. ft.	1428	1715	2020	2255	2465	2670	2845	3020	3195	3340	3500	3600	3770	3900	4030
							hp.	1.56	2.87	4.40	5.88	8.10	10.20	12.40	14.80	16.9	20.0	22.85	25.6	28.8	32.	35.3
6	27	2.875	0.219	10	0.546	7.06	r.p.m.	1140	1400	1615	1800	1975	2140	2280	2420	2555	2675	2795	2880	3025	3130	3240
							cu. ft.	1765	2160	2495	2790	3050	3310	3520	3740	3950	4130	4320	4450	4670	4830	4990
							hp.	1.93	3.54	5.44	7.62	10.00	12.66	15.35	18.35	21.6	24.8	28.25	31.6	35.6	39.7	43.6
7	32	3.375	0.305	11.75	0.754	8.39	r.p.m.	963	1180	1360	1520	1660	1800	1020	2035	2150	2250	2350	2420	2540	2625	2720
							cu. ft.	2435	2985	3440	3850	4200	4560	4850	5150	5450	5700	5950	6140	6440	6660	6880
							hp.	2.66	4.89	7.50	10.5	13.80	17.45	19.90	25.25	29.8	34.2	38.9	43.6	49.2	54.6	60.25

tions per minute, hung from ceiling, and each belted direct to a 12-inch double emery wheel; motor pulley 4 inches; emery pulley 6 inches. There are also four 0.5-horsepower motors installed in this department; one is belted to a small lathe and three are each belted direct to a drill press. The speed of these motors is 1,800 revolutions per minute.

Buffing Room. A 10-horsepower motor operating at 1,800 revolutions per minute is connected to a line shaft, operating at 450 revolutions per minute, which drives one 5-ampere 110-volt generator, four double buffing wheels and small exhaust fan.

Foundry. A 15-horsepower motor, running at 900 revolutions per minute, drives a line shaft in the foundry which operates seven tumbling mills and a small exhaust fan. The motor pulley is 9 inches and the shaft pulley 48 inches. The cupola blower, which is a Sturtevant No. 9 double-drive blower, is belted to a 20-horsepower motor running at 1,800 revolutions per minute. The motor pulleys are 11 inches in diameter.

TABLE II.

Machine.	Horsepower.
Root blower No. ¼	5
Root blower No. ½	6
Root blower No. 1 cupola 1.5 tons	7
No. 2 cupola 2.5 tons	10
No. 3 cupola 3.5 tons	15
No. 4 cupola 5.5 tons	25
No. 5 cupola 9 tons	35
No. 6 cupola 13 tons	45
No. 7 cupola 18 tons	60
No. 8 cupola 24 tons	80
No. 9 cupola 35 tons	100
Casting rattlers	2 to 12
Casting grinders	3 to 5
Emery wheel, 6 inch	1
Emery wheel, 10 inch	2
Emery wheel, 12 inch	3
Emery wheel, 18 inch	5
Double buffing and polishing machines	3 to 10
12-inch buffer	2
16-inch buffer	5
24-inch buffer	10

Group of Tumbling Mills Driven by Motors.

In addition to the foregoing motors, two 5-horsepower motors are installed for operating two elevators, and one 0.5-horsepower motor is belted to a pump.

In another stove-manufacturing plant using motors but maintaining an isolated plant, the following comparative-cost figures were obtained. The first cost of the isolated plant was:

Machine foundations	$ 800.00
1—350-horsepower water-tube boiler	4,100.00
1—350-horsepower water-tube boiler	4,200.00
1—Feed-water heater with oil separating attachment, including freight and installation	1,215.00
1—350-horsepower engine direct-connected to one 200-kilowatt generator, with switchboard and exciter	6,545.00
Pipe and fittings in boiler room	500.00
Pipe and fittings for auxiliaries	4,000.00
Two steam pumps	450.00
Total	$21,360.00

The operating costs of this plant were divided into two parts: (1) fixed charges and (2) running expenses. Under fixed charges the following amounts appear:

Depreciation at 7 per cent on investment of $21,360	$1,495.20
Interest at 5 per cent on the investment	1,068.00
Taxes and insurance	280.00
Total fixed costs per year	$2,843.20

Under running expenses come the following items:

Labor	$2,080.00
Coal	2,000.00
Water	40.00
Oil, waste, etc.	115.00
Supplies	500.00
Total running expense per year	$4,735.00

The total operating costs of this plant are, therefore, $7,578.20 per year. As no change was proposed in the motor installation, the fixed charges on this remain the same for both isolated-plant and central-station operation. However, a small steam plant had to be provided for heating the buildings and for furnishing hot water for elec-

tro-plating. The operating costs of this plant were:

Boiler depreciation and interest at 10 per cent	$ 400.00
Coal	540.00
Labor	900.00
Oil and waste	18.00
Water	20.00
Total	$1,878.00

The records of the company showed the average kilowatt-hour consumption per month to be 17,700. The rate offered by the central-station for this business was two cents per kilowatt-hour, which makes the monthly cost of energy, $354, or $4,248 per year. To this is added the operating costs of the steam equipment as follows:

Cost of steam and hot water plant per year	$1,878.00
Electrical energy cost per year	4,248.00
Total cost when purchasing power	$6,126.00

As the total yearly costs of operating the isolated plant were $7,578.20, the net annual saving by purchasing power from the central-station is $1,452.20.

The foregoing figures may be considered to represent typical conditions as regards the purchasing of power from central-stations, but the savings as shown are only incidental to the advantages of electric drive with central-station power, many of which cannot be directly taken into account when comparing actual costs.

In stove works the various departments are usually widely separated. With steam drive this necessitates long lines of power-consuming shafts and belts with attendant friction losses and frequent breakdowns. No form of prime mover is available, which can economically develop power in small quantities at the points of application. The electric motor furnishes the nearest approach to this condition, in that electric energy can be economically transmitted and transformed into mechanical energy at the point of application in any quantity desired. When compared with line shafting and belts, the installation of wires for carrying electric current is a very simple and inexpensive operation; in comparing the relative losses in transmission, the electrical losses seem almost insignificant.

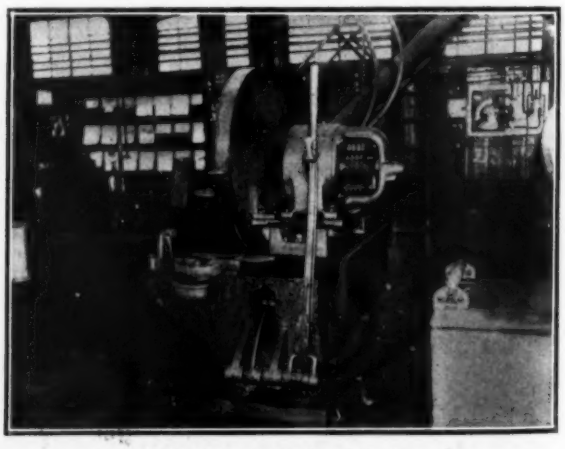
Motor Belted to Cupola Blower.

Regarding breakdowns, when energy is purchased from the central-station there is no possible chance for a complete shut-down due to an accident to any machine. The reliability of supply is in no respect dependent upon one man's watchfulness; seldom is a skilled workman required in the factory to care for the power equipment. With an isolated plant a failure in any part of the plant may cause a complete shut-down for a more or less extended period. Also, a shut-down is liable to be prolonged by inferior facilities available to the operators. The investment charges go on whether the machines are running or not, and every day represents lost production which permits the unfilled orders to accumulate.

It is also well known that when central-station power is used the power cost is directly proportional to the factory output since the power consumed is proportional to the work done. With an isolated plant, owing to the large proportion of fixed charges which are independent of the output, the costs per unit with reduced outputs are high. There are no increases in power-plant equipment required for factory extensions as the central station is always in a position to take care of any demands for power.

In the accompanying data sheets complete tabulated data are given on several typical stove-manufacturing plants purchasing energy from central-station companies.

Motor Driving a Casting-Sand Sifter.



Motor-Driven Casting Grinder.

Stove Manufacturing Data—Sheet No. 1.

The term load-factor is used in these data in such a sense that a load-factor of 100 per cent represents the use for 24 hours every day of power corresponding to the rated capacity of the motors connected. An operating-time load-factor of 100 per cent represents the use of the rated capacity of the motors for the running hours per day specified for each installation.

Bridgeford & Company, Louisville, Ky. This plant manufactures the "Economist" brand of stoves and ranges.

Total connected horsepower, 139.5. Number of motors, 31. Average kilowatt-hours per month, 5,698.

Kilowatt-hour consumption for 9 months: March, 6,630; April, 5,428; May, 6,000; June, 5,987; July, 5,563; August, 4,618; September, 5,104; October, 5,600; November, 6,352. Load-factor, 7.5 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is two-phase, 60 cycles, 220 volts. All motors are of the squirrel-cage induction type.

No.	Horse-power.	Speed R. P. M.	Application.
1	7.5	1,200	Belted to line shafting driving three tumbling mills.
1	0.5	1,800	Direct-connected to centrifugal pump.
1	10	1,200	Belted direct to one large tumbling mill.
1	20	1,200	Connected by silent chain to one Connersville No. 5 cupola blower, speed 190 revolutions per minute.
1	3	1,800	Belted direct to a double-emery wheel.
1	3	1,200	Belted direct to shear.
1	3	1,800	Belted to a countershaft driving elevator.
4	3	1,800	Each belted direct to a double emery wheel, 12-inch diameter.
1	2	1,800	Belted direct to single emery wheel.
1	1	1,800	Belted to jack shaft driving machine lathe.
2	0.5	1,800	Each belted direct to a small machine lathe.
1	0.5	1,800	Belted direct to small drill press.
1	1.	1,200	Belted direct to punch press.
1	5	1,200	Belted to line shaft driving two punch presses; and one cutter.
1	1	1,800	Belted to a line shaft driving two drill presses.
3	3	1,800	Each belted direct to a double 12-inch emery wheel.
1	3	1,800	Belted direct to a circular wood saw.
1	2	1,800	Belted direct to a scroll saw.
1	5	1,800	Belted to a line shaft driving a 12-inch double emery wheel, and one drill press.
1	3	1,800	Belted direct to one American Blower Company No. 6 blower.
1	20	1,200	Belted to a line shaft driving seven double buffers, 12 inch diameter; and one American Blower Company No. 6 blower.
1	10	1,200	Belted direct to plating dynamo, speed, 650 revolutions per minute.
1	10	1,800	Belted to line shaft driving punch presses.
1	5	1,800	Belted direct to exhaust fan.
1	3	1,800	Belted direct to tumbling mill.

Fisher-Leaf Company, Louisville, Ky. This plant manufactures a line of high-grade stoves and ranges, the average daily output being 70 stoves per 10-hour day.

Total connected horsepower, 97. Number of motors, 19. Average kilowatt-hours per month, 2,832.

Kilowatt-hour consumption for 12 months: October, 3,210; November, 3,590; December, 3,650; January, 2,260; February, 3,280; March, 3,640; April, 3,030; May, 2,300; June, 2,300; July, 1,970; August, 2,120; September, 2,640. Load-factor, 5.3 per cent; operating-time load-factor, 12 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is two-phase, 60 cycles, 220 volts.

No.	Horse-power.	Speed R. P. M.	Application.
1	5	1,760	Belted to a 16-foot line shaft, driving one 8-inch forge blower; one double emery wheel; two small lathes and one hacksaw.
1	5	1,760	Belted direct to a plating dynamo.
2	3	1,760	Each belted direct to a 14-inch buffing wheel, speed 2,200 revolutions per minute.
1	3	1,760	Belted direct to a 12-inch double emery wheel, speed 1,450 revolutions per minute.
2	3	1,760	Each belted direct to a 12-inch double emery wheel, speed 1,200 revolutions per minute.
2	5	1,760	Each belted direct to a 14-inch double emery wheel, speed 1,400 revolutions per minute.
1	3	1,760	Belted direct to drill press.
1	5	1,760	Belted direct to 12-inch double emery wheel, speed 1,250 revolutions per minute.
1	3	1,760	Belted to an eight-foot, two-hanger line shaft, driving one 1,200-pound capacity freight elevator; and one 10-inch emery wheel, speed 1,000 revolutions per minute.
1	5	1,760	Belted direct to 12-inch double emery wheel, speed 1,200 revolutions per minute.
1	5	1,760	Belted direct to 16-inch exhaust fan, speed 2,100 revolutions per minute.
1	10	1,760	Belted direct to double polishing lathe, speed 1,800 revolutions per minute.
1	5	1,400	Belted to 10-foot shaft, driving two 4 by 6-foot and two 5 by 4-foot tumbling mills, speed 150 revolutions per minute; and one 12-inch fan, speed 2,200 revolutions per minute.
1	5	Varying	Direct-connected to mechanism of 1,200-pound freight elevator.
1	20	1,160	Geared direct to one No. 4 Buffalo blower, speed 800 revolutions per minute.
1	5	1,760	Belted direct to 14-inch saw.

Stove Manufacturing Data—Sheet No. 2.

Mobile Stove Works, Mobile, Alabama. Running hours per week varies.

Total connected horsepower, 60. Number of motors, 2. Average kilowatt-hours per month, 3,295.

Kilowatt-hour consumption for 12 months: January 4,750; February, 2,440; March, 3,130; April, 3,220; May, 3,170; June, 3,100; July, 2,830; August, 2,750; September, 2,670; October, 4,700; November, 3,750; December, 3,030.

Load-factor, 12 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts.

No.	Horse-power.	Speed R. P. M.	Application.
1	40	1,200	Belted to line shaft, driving two vertical boring mills; one radial drill; six small lathes; one shaper; one key seater; one planer; one Universal grinder; two 10-inch emery grinders; one vertical drill; one drilling and tapping machine and one hacksaw.
1	20	1,200	Belted to line shaft, driving one 36-inch cupola blower; three tumbling mills; one emery wheel; and one sand mill.

Energy is supplied by the Mobile Electric Company.

Malleable-steel stove plant, the principal operations in which are punch and press work, grinding and assembling. There are 200 men employed, working 10 hours per day. The average daily output is 90 stoves.

Total connected horsepower, 150. Number of motors, 10. Average kilowatt-hours per month, 12,100.

Kilowatt-hour consumption for 12 months: October, 12,408; November, 11,143; December, 12,577; January, 11,945; February 12,312; March, 14,068; April, 12,883; May, 2,905; June 14,060; July, 15,384; August, 13,926; September, 11,595.

Load-factor, 14 per cent.

The electrical energy consumption per stove is 5.37 kilowatt-hours.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts. Motors, except where indicated, are of the squirrel-cage induction type.

No.	Horse-power.	Speed R. P. M.	Application.
1	10	1,120	Belted to 90-foot shaft, driving one Smith & Mills eight-inch shaper, one 12-inch engine lathe; one 24 by 24-inch planer; one eight-inch emery wheel; one 16-inch drill; one 12-inch hacksaw; one Toledo No. 77 press; one No. 17 press; one No. 6 press; one Toledo No. 94-C punch; and one Excellsior 36-inch shear.
1	30	1,120	Belted to a 35-foot shaft, driving one 36-inch exhaust fan; one 12-inch double emery wheel; and one automatic grinder having eight 12-inch emery wheels.
1	10	1,120	Belted to 30-foot shaft, driving one 10-inch buffing wheel; two 12-inch emery wheels; and one 12-inch double emery wheel.
1	20	1,120	Belted to 60-foot shaft, driving six 12-inch double emery wheels; one Toledo 1,000-pound drop-hammer; one 12-inch emery wheel; and one 24-inch by 42-inch tumbling mill.
1	15	1,120	Belted direct to a 7.5-kilowatt, six-volt, electro-plating generator.
1	20	1,120	Belted to a 50-foot shaft, driving one double 55-inch exhaust fan; and six double emery wheels.
1	10	1,120	Belted to a 70-foot shaft, driving one 12-in. double emery wheel; one sheet-metal bending roll; one 2,000-pound freight elevator, and one one-eighth-inch rivet-making machine.
1	5	1,120	Belted to a 40-foot shaft, driving one 12-inch cutoff saw; and one 2,000-pound freight elevator.
2	15	840	Slip-ring motors, each direct-connected to drum mechanism of a Reedy 4,000-pound elevator.

The Graff-Webb Company, Louisville, Ky. This plant manufactures a complete line of cookstoves and heaters, about 22,000 pounds of metal being worked per ten-hour day.

Total connected horsepower, 80. Number of motors, 7. Average kilowatt-hours per month, 7,275.

Kilowatt-hour consumption for 12 months: October, 4,970; November, 6,090; December, 5,580; January, 6,180; February, 5,950; March, 5,800; April, 6,170; May, 7,320; June, 7,900; July, 9,600; August, 7,810; September, 13,940.

Load-factor, 16 per cent; operating time load-factor, 37 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with the respective drives. The supply source is three-phase, 60 cycles, 220 volts.

No.	Horse-power.	Speed R. P. M.	Application.
1	5	1,800	Belted to countershaft of cinder mill, two feet, six inches in diameter by two feet, six inches long.
1	10	1,200	Belted to 50-foot, seven-hanger shaft, and 9-foot countershaft driving one freight elevator; five 14-inch double emery wheels; and one drill press.
1	10	1,200	Belted to 20-foot, five-hanger shaft, driving five 14-inch polishing wheels; and one 14-inch buffing wheel.
1	15	1,200	Belted to line shaft, driving seven tumbling mills, three 34-inches in diameter, two 30 inches, and two 24 inches.
1	5	1,800	Belted to line shaft, driving one 600-ampere electro-plating dynamo; and one 14-inch emery wheel.
1	5	1,800	Belted direct to one 2,000-pound freight elevator.
1	30	1,800	Direct connected to one No. 8 Sturtevant 48-inch cupola blower.

Commercial Practice
Management, Rates, New Business

HOW TO INCREASE THE POWER LOAD OF SMALL CENTRAL-STATION COMPANIES.[1]

By D. Davis.

The short answer to the question, "How to Increase the Power Load," is, "add to the new business department a power specialist—an expert solicitor familiar with operating conditions and costs of independent power plants, able to interest prospects and finally to fully protect his employer in the closing of contracts which will insure the central station a reasonable profit."

The short answer in this case, however, does not apply for the reason that we are confined to "small" central-station companies wherein new business departments do not exist and the limited number of prospective customers does not furnish a large enough field for even one special solicitor.

Knowing the usual conditions surrounding the average small central-station company, we can safely assume that the manager of the company in addition to his duties as purchasing agent, auditor, inspector, advertising manager, lightning calculator on house-wiring estimates, demonstrator of electric appliances, political scout and protector of the franchise, defender of the faith in meters, promotor of the science of electricity in the local high school, chief of the bureau of information concerning everything from electric door bells to the Philadelphia moonlight schedule and general utility man in all emergencies; must also, if the power load of his station is to be increased, become responsible for the result of the effort in that direction and furnish about 100 per cent of the required energy.

Before attempting to increase the power load, a careful survey of station conditions should be made and any changes that the company can afford to make in equipment or operating schedule for the purpose of improving the power service should be brought about.

With a correct knowledge of his station capacity, and operating conditions including liability to interruptions, it is possible to avoid taking on any power business that can not be handled in a satisfactory manner—no power contract should be made until all conditions of the proposed service are thoroughly understood and explained, to the end that the consumer shall not expect more than the central station can deliver in quantity or quality of service.

A power rate schedule should be made based upon operating costs and local conditions, keeping in mind that this schedule must cover all classes of service and be so arranged that the long-hour consumer, whose demand is continuous and steady and who avoids the station's peak lighting load, is the customer whose business is most valuable and, therefore, entitled to the most favorable rate.

The power rate schedule should be given very careful consideration and when finally adopted should be so framed that the charges for service will be fair, as between the several classes of consumers, and such that the company can show that its rates are in line with those of other central stations operating under like conditions.

Before attempting to interest a prospect, our manager should familiarize himself with motor prices and should complete arrangements for very prompt shipment of any apparatus required for new customers.

As a necessary step before starting out to secure additional power business, an inspection of each and every power installation on your lines should be made—every power customer should be interviewed and so far as possible every cause of complaint should be removed; every motor should be put in good operating condition; every disputed power account should be adjusted; every power customer should be acquainted with your new rate schedule, if your rates are to be changed, and the effort to increase your power business should be commenced with the feeling that any of your old customers can be used for reference and depended upon to highly recommend central-station power service.

If no regular system of motor inspection is in force, such a system should be established including the examination, testing and cleaning, at regular periods, of all motors to which power is supplied by the central-station, the inspecting, cleaning and testing to be done by a competent man and no charge being made for such service. Any signs of abuse, unusual wear or any evidence of liability of breakdown should be reported at once to the customer and the making of necessary repairs should be insisted upon by the central station.

In addition to a regular and reliable inspection service brushes of all sizes in use and a generous supply of such small repair parts as may be called for on short notice, should be carried in stock so that those who depend upon the central-station as their source of power may feel and know that they are fully protected by an organization which is constantly watching for indications of approaching trouble and fully able and always willing to apply the proper remedy in ample time to avoid the expense and loss of profits and temper usually attendant upon a shut-down.

We have so many positive proofs of the advantages of electricity over all other sources of power that the central station can, in the end, secure the business of every prospect within its natural territory and within its capacity, provided its operating conditions will permit a rate schedule affording an opportunity to compete on anything like an equal footing and, provided, that its service is known to be reliable.

Satisfied that he can properly handle additional business, our central-station manager should make a complete list of all possible power consumers taking as a basis his list of lighting customers, including every shop, store, office, and residence, omitting none and adding to that list the name of every individual or concern in the territory that his power service covers, or is intended to cover, bearing in mind that every place where people live, work or congregate is a prospective location for power-consuming devices.

Small central-stations are located in small cities and towns and in such places the central-station manager knows his fellow citizens, their business, the possibility of their requiring electric power and their ability to pay for appliances and service—therefore,

1. Paper read before the recent convention of the Illinois State Electric Association.

the making of a complete list of prospects within a definite territory is not a difficult matter.

From sources with which we are all familiar, lists showing, in detail, the hundreds of possible applications of electricity in factories, shops, houses and other places may be secured, and from these lists may be selected such devices as may suggest themselves as being adapted to the use of each prospect; and all prospects having been previously recorded on suitable and separate memo cards, all power consuming devices that each prospect might possibly use should be recorded in order of their importance on the proper card.

With his field before him, our manager should select a few prospects who from his knowledge are inclined to favor anything in the way of an improvement, who have the money and are willing to pay for the things they desire and who are located so that the appliances which they may be induced to install can be connected without too much outlay by the central-station.

Every consumer gained is a point scored in gaining the entire field—not only one added, but one more helper in the effort to gain the rest; do not forget to keep the prospect with the profitable load always in mind—the sooner he is on the line the quicker the profits are yours.

In all cases where the prospect is a shop, factory, grain elevator, or other concern where a motor or motors might be installed, a complete list of all machines in use at each place should be made, such list including the name of the machine, its catalogue or size number, with the address of its maker, and to this list should be added a rough drawing showing the location of the various machines to be driven with location of shafting, pulleys and belts showing speeds at which the several machines are operated with a statement of any unusual conditions that may be in evidence.

To such list should also be attached all the data that can be secured showing the various items of expense and total cost of power used by the prospect. This data can usually be secured from the prospect himself who, as a general rule, is willing to give the central-station a figure representing about half or less of his actual expense for power. Because you know that such figures furnished by a prospect are not correct, do not always conclude that your prospect is a member of the Ananias Club—in most cases he does not know what his costs actually are.

In small cities and towns it is quite an easy matter to learn all about the cost of operating the power plant of any local enterprise and if a motor prospect requires special attention and must be "shown," the central-station man can always find channels through which the information necessary to enable him to compile an accurate and detailed statement of costs may be had.

If an estimate of the amount of electric current required to operate certain machines is desired, the manufacturers of such machinery are usually willing to furnish the desired information though quite often inclined to understate the power necessary to pull their appliances at proper speed. In this connection you can use your friends who manufacture motors and who have on file data covering the actual operation of electrically driven plants and machinery of all kinds and under all sorts of conditions.

When you take up a motor prospect, one who takes nothing for granted, and must be convinced, you should have your estimate of the amount of electric current he will use ready before he asks you for it—be prepared in advance—it may take some time and trouble—but it will pay you to be ready and to be in position to make a positive statement.

In making up your estimate covering motors for driving a number of machines, always inspect the condition of all shafting, bearing and belt drives—you will find cases where more power is being used in transmission than in pulling the actual working load. In such a case it is usually easy for the central-station to show satisfactory results provided faulty conditions are known and are remedied at the time electric power is installed.

If you have on your list any grain elevator or other prospect and know that a similar concern located in some neighboring city or town is operating under like conditions and driven by central-station power, always secure detailed information concerning the cost of operation and the results obtained there, by writing to your neighboring central-station and to the owner or manager of the elevator or concern in question—the information furnished by your fellow worker will generally be clear and may include some suggestions as to conditions to be avoided in handling your prospect and the data received from the operator of the elevator or other concern will have great influence with your prospect.

When figures, promises, reference and other efforts will not bring results, you have always another argument which is to install a motor on trial.

As the man who will take no chances is often inclined to be a sharp trader, all motors furnished for a trial should be put in with a perfectly clear understanding as to what your contract shall be if the trial is a success. Whatever your argument may be, let it be clear.

Do not forget that your friend, the manufacturer, is interested in every motor prospect—his is the first profit—he is looking for business—he wants to help you—permit him, let him, ask him, urge him, make him, help you. His representatives should and do have a better general knowledge of motor installation than the manager of the ordinary small central-station. When you have your data complete and have approached a prospect for a motor installation and have failed to make a contract—tell the motor-manufacturers' representative and send him to see your man—he knows all about motors and is not afraid to tell your prospect of the advantages of central-station power—he will tell him of all those advantages and perhaps—some more. If he does not make a sale, he has brought the subject to the attention of your prospect and that will help to bring about the desired result.

Your list of prospects should be handled along the line suggested—working on the most desirable and most favorable prospects first—not overlooking the fact that any one of your hard propositions may, by some change in conditions or circumstances become a favorable and highly desirable prospect, keep your list well in mind and be ready to act promptly whenever circumstances present a chance to increase to your power load.

If you have a prospect now using steam and whose engine or boiler, or both, are in bad condition, make it your business to know what complete repairs or a new steam outfit will cost him—make a note of this information and do not allow him to spend any money along that line until he at least knows what a motor will cost and in such cases do not fail to include the cost of smoke stacks, piping, brick work and foundations on the side of the steam plant.

As previously stated, the manager of the small central-station usually knows all about the people and the business of his city or town but no central-station manager knows or can tell when a power prospect may need, or call on him for information or assistance—therefore, keep before you the motto—be prepared.

The suggestions herein are prompted by a review of an experience covering the securing of a fair motor load for a small central-station, no special solicitors having been employed, no advertising having been attempted and no so-called "campaign" planned or worked out, except as mentioned.

Electric Power for Coal Mining.

One of the largest coal-mining companies in Colorado recently closed a contract with the Northern Colorado Power Company, whereby the latter is to supply it with 32,000 horsepower for operating the machinery in its twelve mines in Boulder and Weld Counties.

In every instance electricity is to supplant steam power, with which the fuel company has operated since its plants were started. In view of this and the fact that the coal company is displacing machinery operated with coal mined on the premises, and therefore very cheap, the installation of electrically driven equipment in the mines is considered ample proof of the superiority of electric current, both from an operative and economical point of view, over other kinds of power.

Vice-President D. W. Brown, who represented the coal company in the negotiations, stated that electricity had been installed because of the economy effected. He said that the experience of his company with electric current for driving machinery in its mines in the southern part of the state had convinced the management of its superiority over other power.

The main generating plant of the Northern Colorado Power Company is at Lafayette, where 6,000 horsepower are developed. W. J. Barker, general superintendent of the Denver Gas & Electric Light Company, is president.

Rochester Adopts Three-Charge System.

A new schedule of rates for electric energy was put into effect on November 1 by the Rochester Railway & Light Company, Rochester, N. Y. The new system combines a meter rate of one cent per kilowatt-hour with demand and consumer charges, depending upon the maximum demand as follows: class 1, maximum demand from 7.5 to 25 kilowatts, monthly winter and summer consumer charges, $2.50 each; monthly demand charge, summer $3, winter, $3.60; class 2, maximum demand from 25 to 75 kilowatts, monthly summer consumer charge, $18.75; monthly winter consumer charge, $21.25; monthly summer demand charge, $2.35; monthly winter demand charge, $2.85; class 3, maximum demand above 75 kilowatts, summer consumer charge, $127.50; winter consumer charge, $152.50; monthly summer demand charge, 90 cents a kilowatt; monthly winter demand charge, $1.10 per kilowatt.

This schedule is the result of three years of study on the cost problem by John C. Parker and his assistant, H. C. Duffenbaugh, of the Engineering Department. The schedule for residence lighting will not be altered at present.

Gasoline Versus Electricity for Sawing Wood.

A little more than a year ago the Red River Power Company, Grand Forks, N. D., succeeded in inducing the Fairchild Fuel Company to install an electric motor for the operation of a saw, displacing a gasoline engine. Recently the company received a letter from the fuel concern comparing the cost of operation by electricity with the cost of operation by gasoline. The letter in part follows:

Gasoline power, September 5, 1910 to September 5, 1911.

Cost of gasoline	$ 57.48
Repairs and batteries	60.65
Total	$118.13

The average cost of the gasoline was 15 cents per gallon. 906 cords of wood were sawed at a cost of 13 cents per cord.

Electric power was used from September 5, 1911 to September 5, 1912.

Cost of current	$88.25
Repairs, fuses and brushes	9.46
Total	$97.71

1,178 cords of wood were sawed at an average cost of 8.4 cents per cord.

In other words, the fuel company was able to saw 30 per cent more wood at a total cost reduction of 21 per cent, and the average cost per cord for sawing was 54 per cent less than formerly.

Pulmotor Service.

The Public Service Corporation, Newark, N. J., has installed a pulmotor, to resuscitate persons overcome by electric shock, gas or smoke fumes, etc., and placed it at the service of physicians or responsible parties. The device is arranged on an emergency automobile for which an ambulance permit (of unlimited speed) has been granted.

A pulmotor was recently purchased by popular subscription in Greeley, Colo., for use in emergencies, and assisted in saving a life shortly after it arrived in the city.

Reduction in Lamp Prices.

The Edison Electric Illuminating Company of Boston has, following the manufacturer's reduction in price, reduced the price of all Mazda lamps ten cents each. Customers entitled to free renewals of carbon incandescent lamps can now obtain the Mazda lamps, either plain or bowl-frosted, at the following excess prices:

	New Price
15 watts	$0.25
25 watts	.25
40 watts	.25
60 watts	.35
100 watts	.40
150 watts	.65
250 watts	.90

The Public Utilities Company, of Lexington, Ky., is furnishing a display room in which all kinds of current-consuming devices will be exhibited. The company will be pleased to receive catalogs and devices on consignment from manufacturers.

The Steam Hammer in Machine Shops.

Every central-station power salesman has at some time or other failed to close a good contract with some machine shop or foundry on account of a steam hammer or two. It has been demonstrated that with a good compressor such hammers can be operated by air with fair economy.

The Louisville Lighting Company, of Louisville, Ky., has recently acquired a customer who uses two air-driven hammers, the compressor being electrically driven. The hammers are rated at 1,500 and 600 pounds, respectively. They are used principally for forging wagon axles. The compressor is an Ingersoll-Rand, Type 10, two-cylinder machine, with a normal speed of 175 revolutions per minute. The high-pressure cylinder is 9 by 12 inches; the low-pressure, 14 by 12 inches. The capacity of the compressor is 372 cubic feet of free air per minute. It is connected to a supply tank 8 feet high by 42 inches in diameter, and is equipped with an Imperial unloader. The safety valve is set at about 120 pounds, and the automatic unloading device operates at a slightly lower pressure.

The compressor is belt driven by a 65-horsepower, 220-volt, three-phase, motor running at 860 revolutions per minute. A belt-tightening idler is used. The average current demand while the hammers are in use under general conditions is about 40 kilowatts. The demand while hammers are not in operation is 30 kilowatts. During a test in which two-inch axles were forged at the rate of 40 per hour, 49 kilowatt-hours of energy were required per hour. This is a higher current consumption than is required under ordinary working conditions, the reason being that the men were working with extreme regularity and minimum loss of time.

The company operating these hammers is well pleased with the results so far obtained. The machine has been in operation about four months. It might be interesting to note that this class of work can in most cases be kept off of the power company's "peak." There are exceptional cases when hammers are operated during the entire running hours of the shop. Consequently such business with its high load-factor during running times is very desirable even at low rates. Steam hammers require considerable boiler capacity and if operated only intermittently necessitate the operation of boilers at low economy much of the time in plants where power is required for other machines. Whether or not this class of business comes within the scope of the central-station company, of course depends greatly on the relation of the hammer to the balance of the plant.

Electrical Construction

CONCEALED CONDUIT WORK IN REINFORCED CONCRETE BUII DINGS.

By Ben R. Browne.

Since concrete buildings are so popular in large cities, a few hints on the installation of conduit work for electric service in buildings of this kind may possibly prove of value.

In putting in work like this the first thing necessary is to locate the outlets properly, and while this is being done allowance should always be made for the forms used in molding the concrete.

The floors, or slabs, have usually to be laid very soon after the conduits are installed for the ceiling outlet. Therefore, the writer always follows the plan of starting the runs of conduit from the first outlet near the center of distribution or panelboard, and, at the proper point, bending an ell in each run of pipe so as to make the conduit reach a convenient distance below the ceiling, the vertical piece being extended downward in a wall slot. Further extensions can be made here to carry the tubes to the panelboards at some later and more convenient time.

Standard outlet boxes should be used in the ceiling and these should be installed in the manner indicated in Fig. 1. The boxes are placed with the face downward, of course. They must be fixed in place in a substantial way, for the cement workers are certain to wheel over them in laying concrete or iron. The device the writer uses in putting the box in position and making sure that it will stay there consists of an ordinary gas-pipe tee and a nipple. The figure referred to shows how these are employed and gives the sizes of the tee and the nipple. The outlet-box cover raises the box high enough to get a smooth finish in the cement, and the nipple may be used to hang a fixture from, or it may be hacked out of the tee and another piece of a more suitable kind put in its place. Short pieces of three-eighths-inch pipe (say five inches long) may be placed in the ends *A* and *B* of the tee to give the work additional strength if this is deemed necessary.

The three-eighths-inch locknut on the lower end of the nipple should be screwed up tightly against the board in order to prevent any movement due to the hard knocks the conduit is sure to get before it is finally covered up. It is not a bad plan to place a larger washer under the locknut, since this gives additional holding power. These locknuts should be removed when the concrete has set; otherwise the laborers are liable to spoil the threads on some of the nipples while they are tearing the forms down.

In running the conduit from outlet to outlet, long easy bends may be made, as these are not seen after the building is finished. It is well to white-lead the joints in the conduits, but this is not especially necessary if the joints are made up in a careful manner. They must not be left loose, though, for if they are cement may seep into the pipe and form a solid pencil, which will block the fishing-in of the wires. The writer had this actually occur once, but fortunately the obstruction was formed near an outlet where it could be easily removed. In ten years' work on large installations he has never had a pipe abandoned because of its being filled with cement.

It may be necessary to put wooden plugs in the ends of some runs, but nothing is needed in the boxes, as the excess water should run through the boards. The conduit is laid down with the reinforcing iron either under or over it, as the engineer permits, and can be placed in columns for bracket outlets in the same way, with modifications to suit the design of the building. Switch outlets are usually in walls or partitions and the conduit will have to be brought through the forms in the line of the partition. Accuracy of measurements cannot be too much emphasized, for it is too late when cement sets to change the position of outlets.

Conceal conduit work is the only way to insure the best sort of installation for the type of building under consideration. Where it is possible to locate the outlets on the plans of the building especially convenient means of hanging the conduits may be provided. But this is apart from the subject.

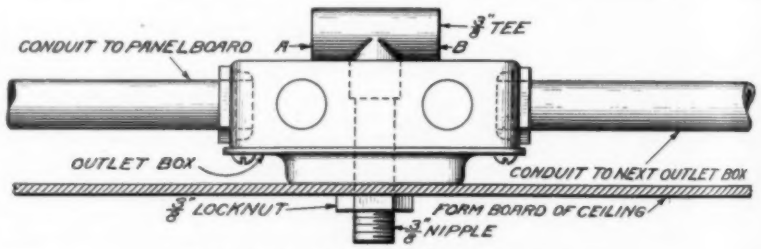


Fig. 1.—Method of Securing Box in Position.

An Exhibit of Wiring Devices.

Space has been set apart in the Electrical Engineering Department of the Massachusetts Institute of Technology for a permanent exhibit of wiring devices. Panel boards showing the various devices are arranged on the walls of the room and in the middle, a single room of frame-house construction is wired with the approved methods of open and concealed wiring, illustrating the rules of the National Electrical Code. A large number of manufacturers have contributed sample boards and literature to this exhibit, and it will probably become the most comprehensive of its kind in the country.

Installing Meters in Iron Cabinets.

The Commonwealth Edison Company, of Chicago, has sent a circular letter to the electrical contractors in the city, explaining that the company does not desire meters to be installed in iron cabinets. It is pointed out that the fields of the meter may be affected by the proximity of iron. The company requests that when he receives specifications which state that the meters are to be installed in iron cabinets, the contractor call the attention of the architect to the fact that it does not desire such an installation. If a situation arises where the cabinet installation cannot be avoided, the company insists that the minimum distance between the meter cover and side of the cabinet be 15 inches on all sides.

A SYSTEM OF ACCOUNTING FOR ELECTRICAL CONTRACTORS.—III.

By F. L. Decker.

In the accounting system under consideration a journal is seldom used. A journal sheet is shown, however, in Fig. 10. Older methods of bookkeeping always made the journal the original book of entry, but in more modern systems it is only used where entries are made without cash being used in the transaction; as, for example, when a customer pays a bill by giving his note for the amount due. This cannot be recorded as cash received. In fact, there is no way to get it into the ledger except through the journal. Such a transaction is handled as follows. On the left of the light vertical line through Description section of Fig. 10 is the debit side of this section, while the right-hand side of this line is the credit side. Suppose we are taking W. Jones' note for $60 for 30 days, in payment of an account he owes us. We debit **Notes Payable with this 30-day note and** credit Jones for the amount of the bill, entering the amount of the note in the money column.

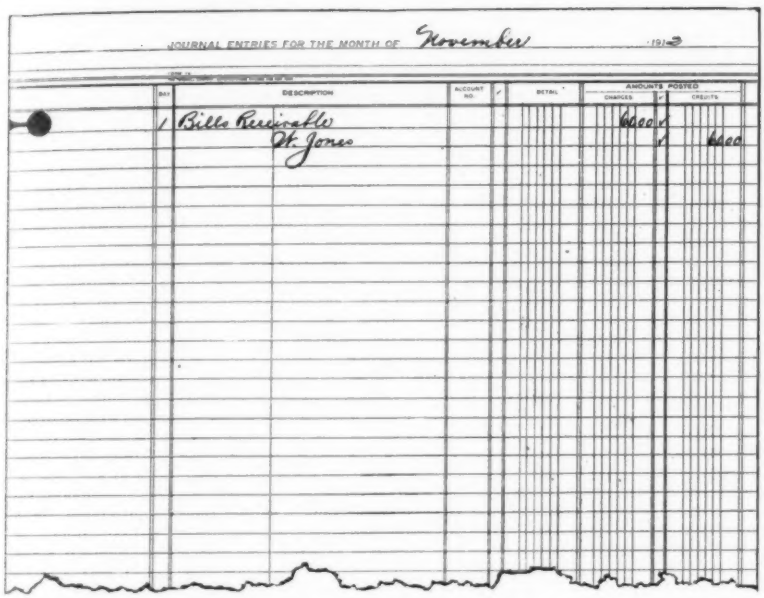


Fig. 10.—Part of Journal Sheet.

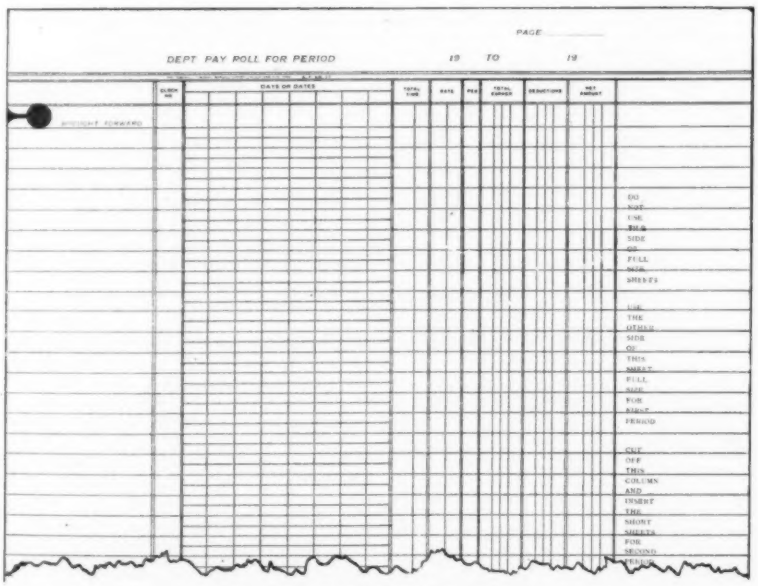

PAGE
DEPT. PAY ROLL FOR PERIOD 19 TO 19
CLOCK NO.
DAYS OF DATES
TOTAL TIME
RATE
PER
TOTAL EARNED
DEDUCTIONS
NET AMOUNT
BROUGHT FORWARD
DO NOT USE THIS SIDE OF FULL SIZE SHEETS
USE THE OTHER SIDE OF THIS SHEET FULL SIZE FOR FIRST PERIOD
CUT OFF THIS COLUMN AND INSERT THE SHEET SHEETS FOR SECOND

Fig. 11.—Part of Sheet from Pay Roll.

The journal is also used to rectify mistakes and overcharges. The procedure is the same as in the case of notes accepted.

Record of Invoices Payable, Fig. 12, is the next form to be considered. Proper keeping of this sheet eliminates a great deal of work. Every bill made in carrying on an electrical contracting business should be carefully entered on this form, and the smallest item of expense should be recorded with the same degree of exactness as is given the larger expenditures, even if the bill is paid in cash. This form is the contractor's original sheet of entry and to get the exact record required in his business he should take it upon himself to see that the sheet is properly kept. As soon as a bill is presented to him, he should make an entry showing the date of it, from whom it is received, and the bill number. This number is given the bill by the contractor himself, and can be written on the face of the bill when it comes to hand. The number given should be fixed by the number in the horizontal line, vertically below Invoice No., in which the record of the bill is made. For example, if the bill is entered in that line which in the vertical column of invoice numbers is marked *100*, then the number *100* should be given the bill and this number written on it.

Under Miscellaneous Credits on the form shown in Fig. 12, there should be entered, in red ink, all items of overcharge. This entry should be made on the line containing the number of the bill, the name of the concern or person to whom it is to be paid, etc., of course. In the Accounts Affected column the number of accounts affected as shown by the Distribution sheet illustrated in Fig. 15 must be entered. The numeral employed indicates what the account is for. For example, the numeral 11 when placed in this column may be understood to indicate that the account is for merchandise, that is, electric-circuit materials and fittings, while other numbers would be called into service to represent other quantities. It all depends on the code which the contractor adopts. If it is considered preferable, "car fare," "merchandise," or whatever else the account affected happens to be may be written in this column instead of the number, so that in posting from Accounts Payable to the Distribution sheet it may be readily seen just where to enter the amount.

In the column of Charge Accounts Payable, Fig. 12, the amount of the bill should be entered at the time it is paid.

After a bill has been entered it should be filed in a suitable file. A very good plan is to use a file with numbers running from *1* to *31* and place the bill under the number corresponding to the day of the month on which it was received. Thus the contractor is sure of not forgetting when the bill is due. Say that a given bill is received on the fifteenth of the month. It is entered on the sheet, Fig. 12, as already explained, and then placed on the file under the number *15*. The

following month other bills are received on the fifteenth. When these latest bills are placed on the file, those filed on the fifteenth of the preceding month are removed and payment of them made, it being understood, in this statement, that goods are usually billed to electrical contractors to be paid for within 30 days.

At the end of the month the contractor foots up the columns of the sheet shown in Fig. 12. The total of the Credit Accounts Payable column is entered in the ledger as a credit to accounts payable; the total of Miscellaneous Credits is entered as a debit to accounts payable.

The date of payment is posted in the last column of this sheet as a ready reference.

It will be noted that the headings in Fig. 15 say "Account No." and "Distribution of—." The distribution is meant to designate one of the following accounts: merchandise; tools and machinery; car fare; office fixtures; office supplies; office salaries, including that of the contractor himself; outside labor; telephone expenses; notes payable; interest on notes payable; association dues; cost of collections; horses, wagons and automobiles; cartage; stock insurance; liability insurance; advertising; and exchange.

The accounts enumerated cover the electrical contracting business rather thoroughly, unless the contractor carries a line of fixtures or runs a large repair shop. If he does either one of these two things, he can easily carry an exact account of all expenditures for each department, or on any item, for each month throughout the year. In connection with the above he must carry an account in his ledger in the preceding paragraph, except labor. Labor and merchandise are as one on the ledger, and labor, being a part of the stock in trade, is only separated in order to find the ratio of the cost of labor to that of material or the ratio of the cost of labor to that of sales. If this information is desired at the end of the month, it is necessary to total each one of the distribution items and enter the totals under their respective accounts as a debit in the ledger.

The debit and credit for this transaction is as follows. The footing of Credit Accounts Payable, Fig. 12, was entered in the ledger as a credit to accounts payable; the credit must be recorded as a debit to each of the eighteen accounts specified above of which merchandise is stated to be the first, as these are taken from the distribution sheets.

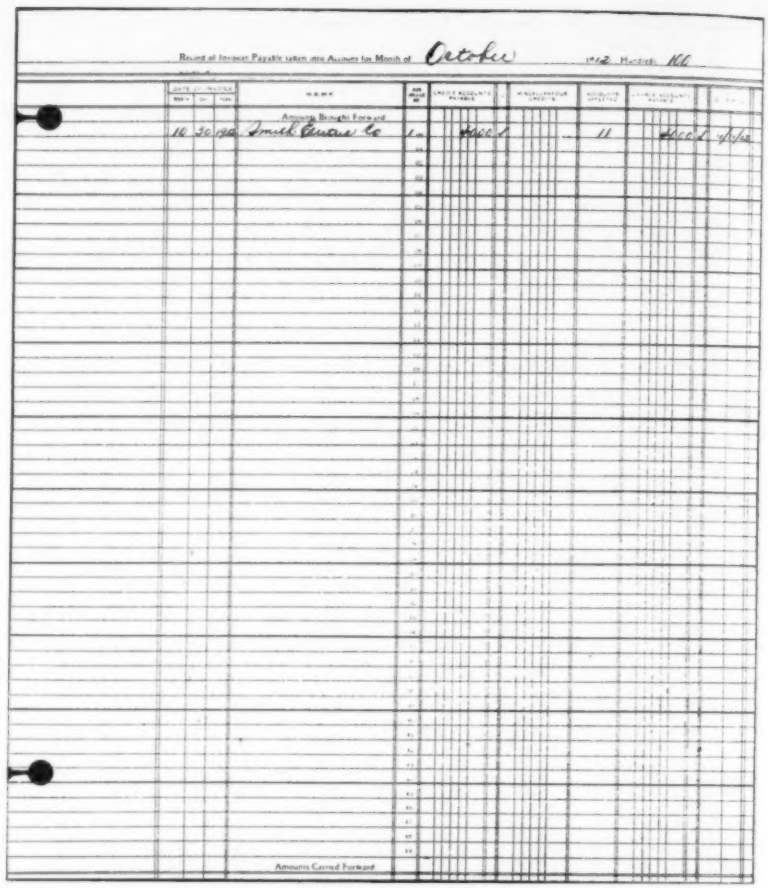


Fig. 12.—Record of Invoices Payable.

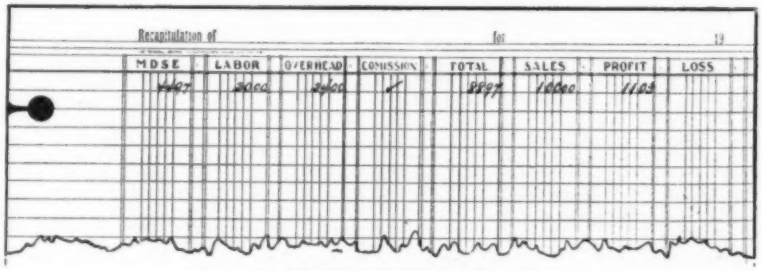


Fig. 13.—Recapitulation Sheet.

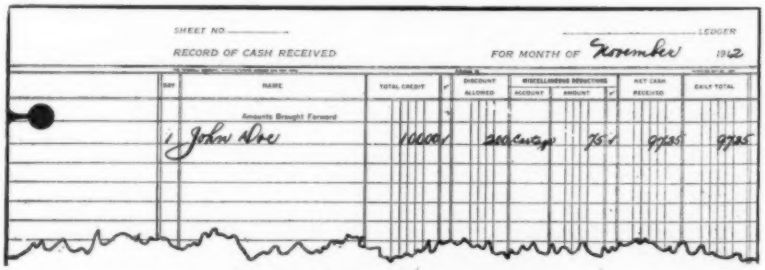


Fig. 14.—Record of Cash Received.

Recapitulation.

Since, on account of the length of it, the description of this accounting system had to be run in three installments instead of being completed in a single article, the writer believes that a summary of the principal steps in the system will make a suitable conclusion of the discussion. Moreover, this summary affords a convenient means of showing how an account has been actually handled on the various forms.

In order to sum up clearly the points that have been brought out, it is necessary to show again portions of some of the forms thaat have been shown before. For the sake of saving space a part of each one of these repeated forms is cut

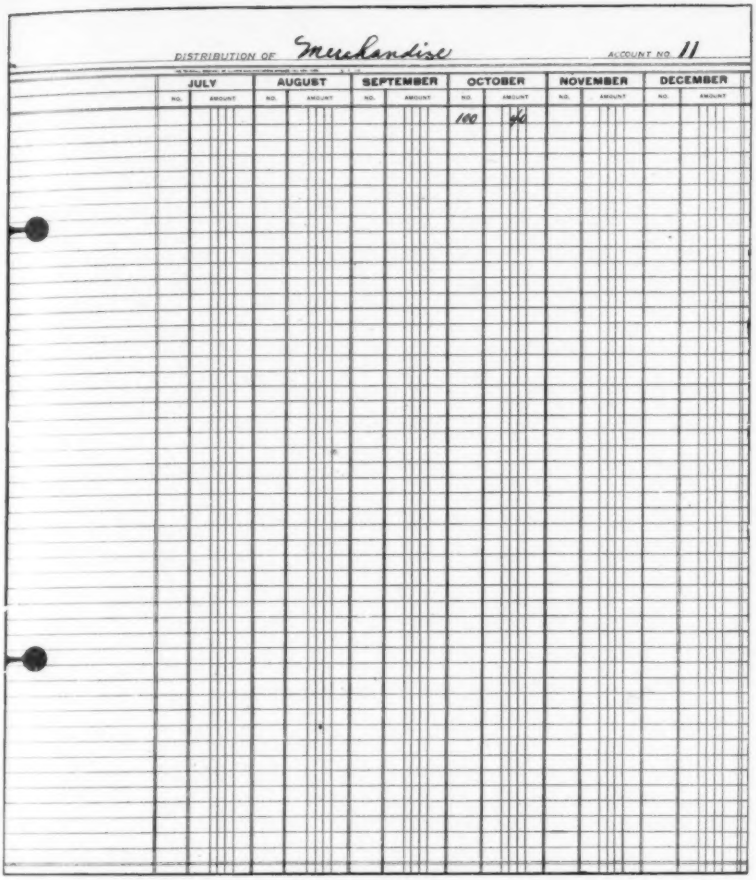


Fig. 15.—Distribution Form.

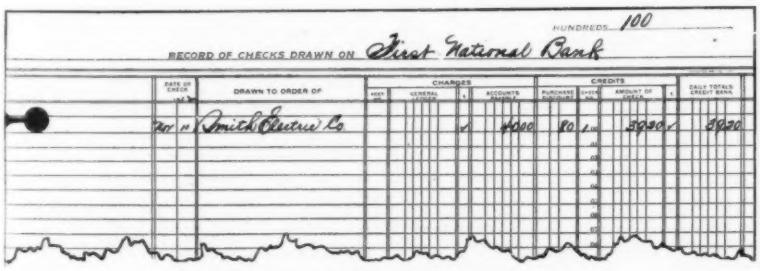


Fig. 16.—Record of Checks Drawn.

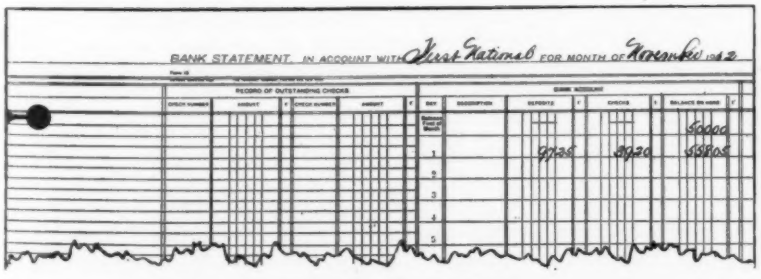


Fig. 17.—Bank Statement Form.

away; and, for the same reason, two of the forms not heretofore published are shown only in part.

The first sheet brought into service in beginning work on a contract is the so-called Charge Ticket. At the top of this little sheet the job number, the name and address of the party for whom the work is to be done, and the date are written, as are also statements as to whether it is tools or materials or both that is to be taken out, and whether what is wanted is for the roughing-in or the finishing of the contract. At the bottom of the sheet there is a space for the signature of the person on the job who receives the material of which this form is made to contain the record. In the body of the form the quantity of each article wanted, the quantity actually delivered, the description of the article and the cost of it are entered. The cost, to be sure, may be omitted if it is tools instead of construction materials for which the requisition is made. These sheets are made in triplicate and may be easily torn from the little inexpensive book in which they are made up. The original of these sheets is kept in the office, while the duplicate and triplicate sheets are carried to the job where the foreman signs them, and returns one to the office and keeps the other. Thus both the office and the foreman secure a reliable record of material wanted, and material delivered, and from this an order can be made for material needed but not delivered because it was not in stock. The signed duplicate sheet is filed by the contractor for future use.

Job Cost Sheet is kept permanently in the contractor's office for each job. On one side of this, at the top, appear the names of the owner and the architect, the location of the job and the job number. The body of this sheet contains a record of the material used on the job, this record being made up from the list of material sent out, as shown on the Charge Ticket, and that returned, as shown by a Credit Ticket. Material returned is entered in the material-credit column of the Job Cost Sheet. The reverse side of this sheet is for a record of the cost of labor done on the job.

Orders for work not included in the contract are made out on a Sales Order Ticket, which, like the other two forms just mentioned, has been shown already and need not be repeated. One copy of this ticket is given the foreman, another is sent to the property owner or his architect and a copy is kept by the contractor himself.

When the roughing-in is finished, the contractor bills the customer for 60 per cent of the amount of the contract, and this 60 per cent is entered on the Recapitulation Sheet as a sale. If the 60-per-cent sale happens to amount to $100, then the entry is made to read $100 in the sixth column of Fig. 13. The other items on this sheet are all clear enough, it would seem. It is seen that in the first sale recorded the profit on the work done and the material used amounts to $11.03, this quantity being obtained by subtracting the total, $88.97, from the amount in the sales column.

The next form described was the Record of Cash Received. It will be observed from Fig. 14 that while the amount nomi-

nally due from John Doe was $100, he was allowed a discount of 2 per cent for prompt payment, and that the contractor also allowed a charge made by John Doe of $0.75 for cartage, so that a total deduction of $2.75 is made from the bill.

The sum actually received from John Doe, therefore, is $97.25. On the ledger John Doe is credited with the $97.25 and also with the $2.00 discount allowed and the $0.75 cartage, in order to offset the $100 charge.

The $97.25 received is put in the bank, and the deposit is entered in the Bank Statement kept by the contractor, a portion of which form is shown again in Fig. 17. There was already a balance

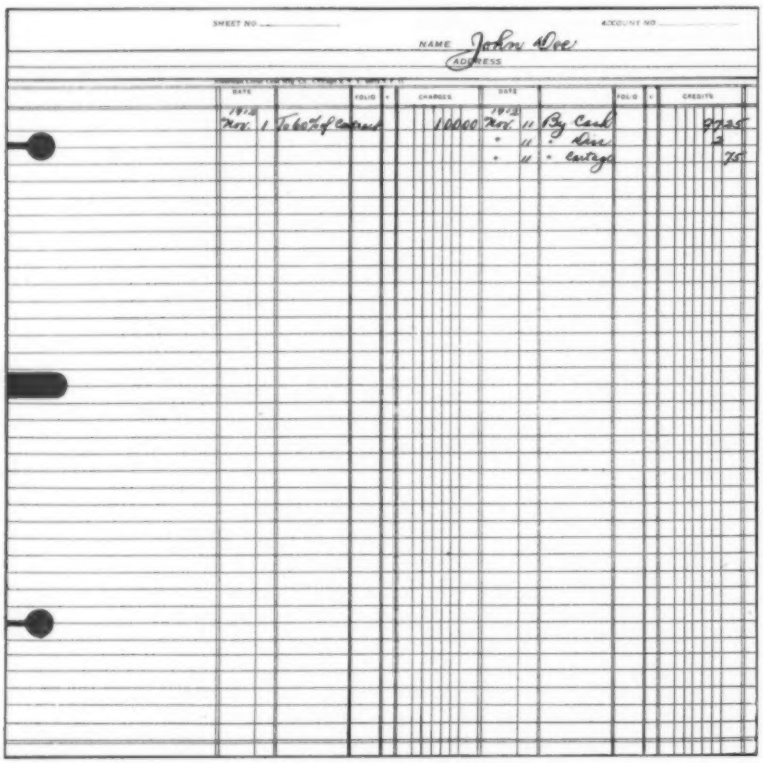


Fig. 18.—Sheet from Ledger.

of $500 on hand; but from the sum of this and the $97.25 deposited $39.20 in checks drawn must be deducted in order to find the contractor's actual balance of $558.05 in bank.

The check for $39.20 was drawn to pay the Smith Electric Company on account due. The amount due this concern was $40, but a discount of 2 per cent was allowed. The Record of Checks Drawn shows the transaction with the company mentioned.

Fig. 10 is a part of one of the journal sheets. The use of the journal has been fully described already in the present article.

By referring to Fig. 12 it may be seen how the transaction with the Smith Electric Company is entered on the Record of Invoices Payable. As explained already, the numeral 11 in the Accounts Affected Column is understood by the contractor using the system to mean that the account with the Smith Electric Company was for merchandise bought from the firm. It should be noted that the correct entry here is $40, and not $39.20. The sum to be entered on the Distribution of Accounts sheet shown in Fig. 15, however, is $40.00. The number of the account with this company is 100, as is shown at the upper left-hand corner of the figure.

It is not considered necessary to make any entries on the Department Pay Roll form, shown in Fig. 11. The correct method of posting up the Pay Roll is easily apparent from a study of the form itself. Perhaps it should be explained, though, that the Clock Number column is used by contractors who have their employees punch a time clock when beginning or quitting work. Where this practice is not employed, the column may be used for check numbers, where time checks are made use of, or it may be left blank. The name of the workman is written in the first column on the left, under the heading "brought forward."

Lest the reader get the impression that the system of accounting described in the foregoing involves the use of so many different forms as to make it unwieldly and awkward, the writer wishes to state that, on the contrary, the sheets are brought together in such a way as to make the set of books required unusually compact and convenient to handle. The Charge, the Credit and the Sales Order Tickets are made up in small tablets with paper covers; the ledger is a book within itself, of course; the other forms are all of the same size, and a suitable binder for them is supplied at a very reasonable cost. From the writer's own experience in keeping track of accounts in the electrical contracting business he is led to believe that a briefer or more compact collection of accounting forms could hardly be made to meet, in any way at all adequate, the needs of the average contractor.

The Illinois Electrical Contractors' Association has bought a number of sets of these books and is distributing them among members at cost. If there are contractors in other sections who are especially interested in the system, the author of these notes will gladly answer any questions that they may care to submit, as fully as possible.

The system, as the foregoing shows, makes conveniently accessible at all times a great deal of data not accessible at all where one of the old forms of cost-keeping is employed.

Connecting Small Motors on Lighting Services.

The Commonwealth Edison Company, of Chicago, allows electric motors of one horsepower or less to be connected to lighting services, except that alternating-current motors which must be started and stopped frequently may not be so connected. This rule is intended to provide for the operation of motors for driving sewing machines, coffee mills, electric pianos, shoe-repairing machines, etc., on lighting services. The company permits motors for driving vacuum cleaners in private residences and apartment houses to be run on the lighting service also. Where such machines are used in cleaning establishments, however, they must not be connected to the lighting service. Motors up to and including one horsepower in capacity for operating house pumps may be installed on the lighting service if the motor is wound for a pressure of 230 volts.

Alaska Increases Copper Output.

The copper production from Alaska in 1911 was 22,314,889 pounds, as compared with 4,311,026 pounds in 1910. The large increase is due to the entrance of the Copper River district into the producing list.

Important production of copper from Alaska began about 1903, since which time it has been a steady contributor of that metal. To the close of 1911 the total production of blister copper has been 59,126,334 pounds.

ELECTRIC CLUB MEETS.

Victor H. Tousley Speaks on Electrical Inspection.

The regular weekly lunch-hour meeting of the Electric Club of Chicago for last week was, in many ways, one of the best of the recent meetings of that body. It was held Thursday, November 7, at the Sherman Hotel. There was the usual table d'hote luncheon, followed by the singing of a number of the more popular songs of the times, at the conclusion of which J. R. Cravath, who, in the absence of President A. A. Gray, presided over the meeting, introduced Victor H. Tousley, chief electrical inspector for the city of Chicago, as the principal speaker of the occasion. In introducing the speaker, Mr. Cravath commented on the large attendance, saying that so many more were present than had been expected that the arrangements committee had been compelled to send rush orders for larger service than had originally been provided.

Mr. Tousley spoke on the growth and the work of the department of electrical inspection of Chicago. He said that the bureau was just now finishing the twenty-ninth year of its existence. The report of the department of inspection at the end of its first year—that is, in 1884—showed that there were only 1,185 incandescent lamps then installed in the city. The most important work of the inspectors at that time was in connection with the maintenance of the city fire-alarm system. In 1883, the bureau consisted of a single inspector; now there are 45 men making inspections regularly. In 1883, the fees collected for inspections aggregated $1,336; last year the sum collected was $124,000. The total number of electric incandescent lamps installed under the supervision of the department in 1911 was approximately 2,000,000, and some 22,000 electric motors were inspected during the same period.

The present city ordinance concerning electrical inspections provides that a permit must be taken out before electrical work can be installed, and that every installation must be approved before the current may be turned on it. Records of each inspection are kept on file at the headquarters of the department of inspection. The work of the bureau makes it necessary to handle about 350,000 of these forms in the office per year now. The largest single installation inspected during the present year is the Rothschild building; here the circuits of 32,000 incandescent lamps and 2,024 horsepower in motors had to be passed upon.

Mr. Tousley explained that the bureau of inspection is under the supervision of the city electrician, and the inspectors in the field report directly to the chief inspector. The city is divided into 23 inspection districts, and certain inspectors are assigned to each one of these. There is also a man for inspecting electric signs and one for inspecting the electrical work in theaters. Signs and theaters are reinspected annually. Moving-picture shows are inspected periodically, the frequency of inspections being determined by the condition of the installation. One man reinspects old buildings, and there are three who, without being regularly assigned to any particular district, are sent wherever their services are most needed.

The bureau has its own laboratory for examining materials for use in electrical construction, and one inspector is in charge of this. Still another is assigned to the office as an assistant to the chief inspector.

The speaker said that for making electrical inspections last year the bureau received $72,000 more than it cost to support it. He believed, however, that all the money paid in to the department could well be spent by it. The bureau, in fact, is not intended to be one for producing revenue.

It was pointed out that the inspection rules of the city of Chicago follow the National Electrical Code very closely, and that the city rules are revised immediately following the revision of the National Code every two years.

Mr. Tousley said that the city ordinances of Chicago do not require the licensing of electricians. Anybody may do electrical work who cares to undertake it; for, so far as the city ordinances are concerned, the only thing necessary before beginning a job of wiring is to take out a permit to do the work, and a man need not be an electrician to get a permit. He thought this very unfortunate. It resulted in the inspection bureau having to teach inexperienced men how to do electrical construction. Sometimes property owners had employed such incompetent men to put in electrical work that the inspection department had been compelled, after work had been improperly installed, to insist that a regular contractor be employed to put the installation in good condition. This was annoying and expensive to the inspection bureau, and meant loss of money to the owner of the property.

Mr. Tousley exhibited a number of lantern slides prepared especially for this lecture. Some of these illustrated the developments in electrical fittings which have taken place within the last few years, in a very striking way, while others showed graphically certain interesting and important facts about the work of the bureau of electrical inspection in Chicago. Among these slides was a photograph of the inspectors who made up the bureau in 1896; and Mr. Tousley explained that, with the exception of two who had died, all the persons shown in the picture were still in the department. The inspectors are protected by civil-service rules, and changes are not made in the personnel of the bureau for political reasons.

Among the Contractors.

H. R. Armbruster, who has been connected with the R. Haas Electric & Manufacturing Company for the last fifteen years, has organized an electrical contracting company at Springfield, Ill. The firm name will be the H. R. Armbruster Electric Company.

John A. Wickum, electrical contractor, 118 North La Salle Street, Chicago, has been awarded the contract to wire a building for J. M. Arnold in that city for 700 incandescent lamps.

F. J. Pieper has opened an electrical-contracting business at 305 Belk Street, Alton, Ill.

W. J. and August Green, of 5100 Woodlawn Avenue, Chicago, have engaged the Wadeford Electric Company, of this city, to install the electrical work in a building in which 700 incandescent lamps will be used.

The Robertson Electric Company, of Owensboro, Ky., has been organized by G. U. Robertson and P. F. E. Lee to engage in a general contracting business and the sale of electrical supplies. The company will maintain offices in Owensboro and Henderson.

Haskell and McKenney, electrical contractors of Portland, Me., have moved from 50 Portland Street to larger quarters at 39 Portland Street, where a line of fixtures and supplies will be carried in stock.

Lowrie Marks, a well known electrical contractor of Danville, Ky., has secured the contract for wiring the big warehouses of the American Tobacco Company in that city. The company will install a great deal of electrically operated machinery, to be used in handling tobacco.

The organization of the Fair Electric Company of Louisville, Ky., which promises to become one of the best known contracting concerns in Kentucky, has been completed. August J. Veth, a well known Louisville electrical contractor is president of the new company, which has offices at 1002 West Main Street. Wade H. Pool, formerly president of the Wade H. Pool Electric Company, is general manager of the new concern.

Dollar Wiring Kinks.

Every reader is invited to contribute to this column. It does not matter how few words are used to explain a "Dollar Wiring Kink," provided the idea is made clear; and if a diagram is necessary, a rough pencil drawing will serve. The idea itself must, of course, be new and bright. A dollar will be sent to the contributor upon publication.

Small Lamps and Condensers in Series.

Sometimes it is desirable to burn a very small incandescent lamp on a commercial lighting circuit of 110 volts. For instance, such a case is found in the illumination of house numbers. Here the smallest 110-volt lamp is more than sufficient. By connecting a Western Electric telephone condenser of four microfarads capacity in series with a miniature lamp taking a small current, the current through the lamp is limited to its proper value. The smaller the lamp and the higher the voltage the smaller is the capacity of condenser required. Each specific case can best be solved by experiment. The writer has used these condensers on 220 volts with success. The simple rule—capacities of condensers is greatest when the condensers are connected in parallel—is well to remember. There is no loss in the condenser. The use of alternating current is assumed, of course.

M. Luckiesh.

Arc-Lamp Trouble.

It frequently happens that when an arc lamp goes out the trouble is due to a burned-out resistance coil. In searching for such a fault I hook one terminal of a test lamp over one terminal of the arc lamp and use the other to explore the circuit through the lamp. On several occasions I have noted that as the test lead was moved across the turns on the resistance coil and happened to bridge the break in the circuit, an arc was formed between the adjacent turns, welding them together and thus completing the circuit. The lamp could then be put into operation again. Consequently when trouble of this kind is suspected I take a screwdriver or other convenient tool and rub it back and forth against the resistance coil to get the same result.

Frank M. J. Murphy.

Fastening Conduit on Brick Walls.

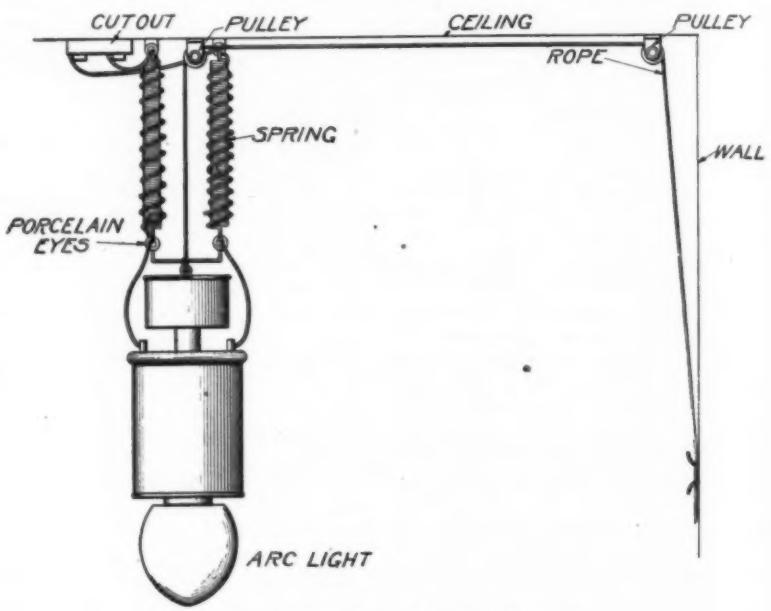
In one of the preceding issues I saw an article on the use of stove bolts wound with wire solder, instead of wooden plugs and screws for fastening conduit on a brick wall. In the article mentioned a piece of gas pipe was used to wedge the solder into the hole.

I have found that after a little use the gas pipe becomes bent, and so have made a special tool for this purpose as follows. In the end of a piece of round iron, the size of the hole in the brick wall, I drilled a hole one-sixteenth of an inch larger than the bolts to be used, and I make use of this to drive the wire into place. Thus I avoid the trouble of cutting a new piece of gas pipe every few hours.

Earl M. Seagrave.

Support for Lamp.

The diagram below shows a temporary arrangement for hanging an arc lamp for a blueprinting machine which is so deep that when the arc is raised the wires would hang low and be in the way. The wire, which is rubber-covered, is coiled around the springs as shown in the sketch, so that when the lamp is raised, the wires cling to the spring and do not hang in the way.



Arrangement of Lamp and Supports for Leads.

A. P. Broadhead.

How to Replace Screws Hard to Reach.

While working at the bench repairing arc lamps the other day, I encountered the difficult task of trying to replace some screws where it was impossible to reach with the hand. It occurred to me that I must have something to cause the screws to stick to the end of the screw-driver blade, while I set them in place. I took a bar of common soap and drew the head of the screw across it filling the slot in the screw with soap, I then placed the screws on the end of my screw-driver blade setting them in place without further trouble. I believe this is quicker and handier for the purpose than to have a spring device fastened to the screwdriver blade as I have seen recommended.

W. A. Hines.

Fishing Through Loom.

In using some of the new small flexible fiber conduit, which is excellent for outlets but difficult to get much of a stretch of wire through, the writer was annoyed by the fabric covering of a certain kind of wire pushing back and so preventing any further crowding of the wire through the loom. So I rubbed the end of a candle on the end of the wire before introducing it into the tubing. The result was satisfactory entirely, and since then I have found that a comparatively long stretch of wire can be pushed through the small tubing quite easily, while with the ordinary one-fourth-inch tubing it is sometimes very hard to thread long runs of it on wire. The candle is better than the soapstone which is supposed to furnish the interior lubricating surface.

C. W. Goddard.

Making Hickey for Bending Conduits.

It has been my experience when using a hickey on conduit to have the handle break off at the threads where it enters the malleable iron tee.

To overcome this, when making a hickey, say of 1.5-inch tee, the handle being 1.5-inch pipe, I drive a short piece of 1.25-inch pipe 7 or 8 inches into the end that screws in the tee. I have used this on all sizes of hickeys, and have not had any trouble with threads stripping or the handle bending. The method may be used on any hickey, provided you have pipe one size smaller in the handle.

Robert Oster.

Loss of Heat from Steam Pipes.

At the recent meeting of the British Association for the Advancement of Science, a paper was read by Petavel and Lander entitled "An Experimental Investigation of the Transmission of Heat." The work was undertaken to determine the relative importance of convection, conduction and radiation in promoting the loss of heat from hot wires and from hot pipes. Measurements were made electrically in some cases and in others by weighing the amount of steam condensed.

The effect of the density of the surrounding air was measured, experiments being made with pipes subjected to an external pressure up to 3,000 pounds per square inch. Under such conditions the loss became enormous.

They found that a one-inch uncovered steam pipe in free air lost heat at the rate of three British thermal units per square foot per hour per degree. Of this, 15 per cent was due to radiation, 4 per cent to conduction and 81 per cent to convection.

The best density of packing material used for lagging was investigated. The best of such materials has a conductivity 30 times as great as air, so that if it were not for convection, covering a pipe would increase the loss of heat. The covering, however, greatly diminishes the convection, by an amount which depends upon the closeness of the packing. If too tightly packed the conductivity becomes too great; if too loosely packed the convection is still excessive.

In the case of slag wool the best density was found to be one-fourteenth of the actual density of the material.

Initiative Used in Ohio.

The Ohio Electric Railway Company, of London, O., is the first public-utility corporation to invoke the initiative and the first initiative election ever held in Ohio took place last week. The contest was between the Ohio Electric Railway Company and the Town Council, relative to a change in the railway's route. The Council rejected the railway's application by unanimous vote, and the company then appealed directly to the voters, who approved the change by a vote of 538 to 463. Interest in the result was so intense that the general election was almost lost sight of, and the vote cast was the largest in the history of the town.

$3,000,000 Power Plant for Leeds.

It is proposed to equip a new municipal power station at Leeds (England) with four 10,000-kilowatt turbo-generators, the cost, including wharf, coaling facilities, roadway construction and land, being estimated at $3,000,000. It has been said against the corporation that it has not charged low enough prices for energy to induce the great industrial works, with which the city is studded, to change over to electricity. Harold Dickinson, manager of the department, says that there is probably 115,582 horsepower installed in workshops and factories of different classes, but only 17,472 horsepower is electrical and from the public supply. Engineering and similar works form the largest class in Mr. Dickinson's tabular return of different industries, and these take 35,000 horsepower, of which 10,136 is electrical. On the other hand, cloth and similar manufacturers which use 19,500 horsepower, only use electricity to the extent of 270 horsepower! It is recognized that most of the non-electrical works could now be won over if charges were low enough, and this $3,000,000 scheme would reduce cost of production.

Public Service Commissions

NEW YORK.

The Public Service Commission for the First District has denied the application of the Mid-Crosstown Railway Company, Incorporated, for permission to issue $500,000 in capital stock, $200,000 in first-mortgage, five-per-cent bonds and $300,000 in five-per-cent, adjustment income bonds. The Mid-Crosstown Company is a reorganization of the Twenty-eighth and Twenty-ninth Streets Crosstown Railroad Company, which owns a line of cars east and west through Twenty-eighth and Twenty-ninth Streets. The Third Avenue Railway Company now operates the road and has substituted electric storage-battery cars for horse cars. The Mid-Crosstown Company intends to sell the property to the Third Avenue Railway Company. The Commission holds that there is no justification for the formation of a new company and the issuance of securities merely for the purpose of selling out to the Third Avenue Company, which can buy direct from the old company. The opinion also discusses the merits of the case and finds that the value of the physical property and the earning capacity of the company are not sufficient, in view of liabilities aggregating more than $163,000 which must be paid, to justify the issuance of securities in the amounts proposed.

The Public Service Commission, Second District, has received notice from the New York Telephone Company that it has purchased and acquired the physical property and business of the Commercial Union Telephone Company, comprising the exchanges at Warrensburg, Lake George, Ballston Spa, Schuylerville, Greenwich and Valley Falls. The notice states that the company anticipates making further purchases of property from the Commercial Union Telephone Company in the near future.

CALIFORNIA.

The Railroad Commission has rendered a decision granting permission to the West Coast Gas Light & Fuel Company and the Home Gas & Electric Company of Newport Beach, Los Angeles County, to consolidate and to issue new securities. The consolidated corporation, to be known as the West Coast Gas Company, is empowered to issue $91,075 of stock and $100,000 of bonds.

A decision was rendered granting permission to the Coast Valleys Gas & Electric Company to take over the property of the King City Water, Light & Power Company.

An order was issued granting permission to the Coast Counties Gas & Electric Company to purchase the Davenport Light & Power Company.

NEW JERSEY.

The Board of Public Utility Commissioners has dismissed the complaint of H. E. Moyer vs. the Pennsylvania Railroad Company. Mr. Moyer complained that he bought a ticket from Riverton to Philadelphia and return; that he went to Philadelphia by trolley, returning by train and offered his ticket at Camden from which the conductor detached the portion good for passage to Riverton. Later on taking a train from Riverton to Philadelphia he was refused passage on the going end of the ticket. The Board decided that the requirement that the excursion ticket shall be presented entire on the going part of the journey is not an unreasonable regulation, citing numerous court decisions upholding this practice.

POWER REQUIREMENTS OF ROLLING MILLS.

Monthly Meeting of American Institute of Electrical Engineers.

The 277th meeting of the American Institute of Electrical Engineers was held at the Engineering Societies Building, New York City, on Friday evening, November 8. President Ralph D. Mershon called the meeting to order and the chair was taken by John M. Hipple, chairman of the Industrial Power Committee. The first paper presented was one by Wilfred Sykes entitled "Power Requirements of Rolling Mills." The second paper was by F. W. Meyer and Wilfred Sykes, entitled "The Economical Speed Control of Alternating-Current Motors Driving Rolling Mills." An abstract of this was read by Mr. Hipple. The two papers were discussed together.

Power Requirements of Rolling Mills.

The paper aimed to indicate the lines of study for determining the correct size and characteristics of motors for rolling mills. The subject is one of great complexity, due to various factors affecting the power requirements and the variation in operating conditions in different works. There is little reliable published data, practice being based mainly upon empirical knowledge gained by experience. Manufacturers of rolling-mill engines have often based their size upon the power required to break some part of the mill. Many superintendents are of the opinion that it is almost impossible to obtain an equipment too large. Improvements in auxiliary apparatus, organization, etc., often result in increasing the output 100 or 200 per cent above the original estimate, and the electrical manufacturer must often take the responsibility for assumptions as to rolling conditions altogether different from those given by the steel-mill engineers. The size of rolls, etc., has comparatively little to do with the size of motor required. The fundamental basis for determining the size of motor is the product of the mill and the tonnage rolled. The principal factors are: (1) volume of metal displaced; (2) method of displacement; (3) temperature of metal; (4) class of material; (5) rate of displacement; (6) class of roll. The author considered a unit of work based upon the volume of metal displaced longitudinally. Where there is lateral displacement also it is usually impossible to determine exactly how the metal flows and the work cannot be simply computed. Examples were given of rolling forms where the pressure is direct and where it is at an angle or almost parallel to the surface being rolled. The temperature of the metal is important, the power requirements varying as the tensile strength of the material. This is small at high temperatures but increases rapidly below about 1,400 degrees Fahrenheit. At 100 degrees it is 18 times as large as at 2,000 degrees Fahrenheit, and tests have shown that cold rolling requires 17 to 20 times as much power per cubic inch displaced. As the area is increased with successive passes the cooling becomes greater and consequently the power required increases rapidly as the cross-section is decreased. Chemical composition has little effect except indirectly, as it determines the temperature at which the material must be rolled. The power increases as the density increases, especially at low temperatures. Most rolling mills run continuously in one direction and to equalize the input flywheels are used. The size of flywheel should be determined in conjunction with the characteristics of the motor and control apparatus. The mill discharges work from 20 to 80 per cent of the time. The motor size cannot be determined upon the basis of rolling so much material per hour, but it must be capable of performing the work while the metal is actually in the rolls, since it is not possible to use flywheels so large that the motor will always carry the average load. A load diagram can be determined from curves showing the power requirements per cubic inch displaced, etc. From this load diagram the average load and size of flywheel can be determined. An example of this calculation was given. To equalize the load on the motor its speed must be regulated. This is usually done with a fixed rotor resistance, so that the speed falls as the load is increased. It is preferable to vary the rotor resistance with the load.

Speed Control of Alternating-Current Motors.

The induction motor has been adopted exclusively for driving rolling mills electrically. One of the most difficult problems is speed regulation, owing to the fact that this type of motor is normally a constant-speed machine. Regarding speed requirements, mills may be divided into three classes; (1) speed adjustment required on account of the large range of material; (2) speed regulation required to enable mill run in tandem with another mill; (3) speed regulation required to obtain certain qualities, finish and accuracy of section for different products. The speed regulation required depends greatly upon the labor operating the mill and its organization and experience. The simplest method of reducing speed with an induction motor is to insert resistance in the rotor circuit. This reduces the efficiency by an amount depending upon the load and the reduction in speed. Where the regulation required does not exceed 15 per cent, this method is the simplest and most satisfactory, and under mill conditions the most economical. With automatic resistance adjustment to vary resistance inversely with the load, it is possible to obtain a speed regulation up to about 30 per cent. Beyond this limit it is not practicable to use rheostatic speed regulation. Multispeed motors provide a method theoretically capable of giving any number of required speeds, but in practice they are limited to about four speeds, two of which are in the relation of one to two. This requires two windings on the stator and two on the rotor. The usual steel-mill motor has not more than three speeds. In most cases two-speed motors have been used. With two synchronous speeds, one about 70 per cent of the other, it is possible to obtain the speed regulation by rheostatic control of about two to one, giving any number of intermediate steps that may be required. The efficiency and power-factor of the multispeed motor is not very much lower than a single-speed machine of the same characteristics. With motors in cascade it is possible to obtain any number of speeds that may be required, this being limited by the cost of the equipment and complication of control apparatus. This arrangement has been used more abroad, but operating conditions are rather unsatisfactory. The use of a three-phase commutator regulating machine with induction motors was discussed at some length and a variety of arrangements described in detail and illustrated. In some cases the three-phase commutator motor can be used for direct drive, and this is quite satisfactory in cases where the power is small. Some method of providing a good commutating field is necessary. In the United States the conditions are favorable for such machines, since 25 cycles is the customary frequency.

J. H. Wilson presented a written discussion which was read by R. H. Tillman. The utilization of flywheel energy is more or less a necessary evil. Its use is made necessary by considerations external to the motor equipment, such as the supply of electrical energy. To obtain energy from the flywheel it must be slowed down. This means adding resistance to the rotor circuit, which results in decreasing the efficiency, especially at heavy loads where efficiency is important. This slowing down decreases the amount of material which can pass through the rolls in a given time. The friction load caused by the flywheel requires additional power, which must be expended when the mill is running idle as well as when it is rolling. The flywheel adds additional expense, due to the maintenance of large, heavy bearings which must be well lubricated and kept in good mechanical condition. The example used by the author was ideal for the use of flywheel equipment, as the passes were short and the intervals between sufficiently long to accelerate. In this case the additional first cost of a large motor would offset the savings from the elimination of a flywheel. Where, however, the average load is much larger while the peaks remain the same, the flywheel would probably not be wanted unless the conditions of power-station capacity and arrangement of mill affect the choice. The ratio of power required to capacity of power station largely influences the matter. The use of a flywheel is more often necessary on this account than on account of the requirements of the individual mill.

Selby Haar pointed out the meager data available on the subject, as instanced by the fact that it all relates to iron and steel. He called attention to the discrepancies in different tests and the difficulty of making them. In constructing a load diagram he preferred dealing with elongation rather than volume of metal displaced.

Edward J. Cheney pointed out the improvement in determining the size of electric motors over the practice which was general with steam-engine drive. If a motor is too large it results in low power-factor, low efficiency and increased first cost. If the motor is too small it does not stall, but continues to work until it is burnt out. This quality of the electric motor has resulted in large increase in production, and for this reason engine tests should be used with caution as a basis for motor sizes. One great advantage of electric drive is the ease with which the power is measured. This gives a check on rolling methods, as well as an easy determination of future installations.

B. N. Westcott told of some of his experiences in making measurements upon rolling mills and the difficulties encountered.

F. Bickford Crosby stated that the General Electric Company had been carrying on tests with the three-phase commutator motor and was ready to supply such equipment, and gave figures for the efficiency of this type of drive. The demand for multispeed motors has rapidly increased.

L. T. Robinson pointed out that nearly every engineering problem involves measurements and spoke of the difficulties connected with the spark method of recording which had been referred to. The high potential necessary to puncture the paper is liable to produce electrostatic effects.

Written discussion was submitted by George Stoltz and H. L. Barnholdt. The former stated that from the peripheral speed of the rolls and the method of handling an estimate could be made of the output.

Wilfred Sykes closed the discussion. He agreed that flywheels are a necessary evil, but they make electric drive commercially feasible, which would not otherwise be true in the majority of cases. The effect of the rate of displacement on the power was not very great and is so involved with other factors that it is not yet possible to say definitely what effect it has. He stated that the use of a rotary converter connected to the rotor circuit had been developed in Europe and was formerly used to some extent, but not at present. Its principal use was in connection with fans for mine work, where it was satisfactory with a frequency of 50 cycles. With 25 cycles, which is common in this country, it would not be satisfactory.

At the close of the discussion President Mershon resumed the chair and adjourned the meeting to the usual smoker in the Institute rooms.

Among the Supply Men

The Southern-Wesco Supply Company, Birmingham, Ala., reports that conditions are very good in its southeastern territory, and that the recent election has had no depressing effect on business.

O. M. Jones, 30 Church Street, New York City, jobber and manufacturers' agent of equipment, supplies and specialties for steam, water, air, gas, oil and for heating and power plants, is desirous of obtaining from manufacturers of similar equipment materials used in connection with these lines, including catalogs, price lists, and jobbers' discounts. He is also open for negotiations with manufacturers to represent them in New York City, the New England States, and the export trade. Mr. Jones has been selling steam goods and equipment for 24 years, and has been located in New York City for the last 18 years.

The Manhattan Electrical Supply Company, 112 South Fifth Avenue, Chicago, has instituted what it calls a "service department." This is in order to facilitate its already excellent service, and the customer is instructed that when he wishes to telephone an order, to get information, or make complaint regarding orders already placed, to ask the operator for the "service department." The company is distributing a poster which makes the above suggestion, including the telephone number and a reference to the department.

The Binford Electric Company, Incorporated, of Richmond, Va., has been established with Julian Binford, Jr., as president and treasurer, as jobber of electrical apparatus and supplies. Mr. Binford was secretary of the Tower-Binford Electric & Manufacturing Company for 17 years. A few months ago he severed his connection with the company, not intending to go back into the business of jobbing electrical supplies, but in view of the fact that he could not find any other line which appealed to him in Richmond, and not wishing to change his residence, he decided to go back into the business. The company is now fitting out new quarters at 1322 and 1324 East Main Street, and will have a floor space of over 20,000 square feet. The store is in one of the best locations in the city for the jobbing business. A general line of electrical supplies will be carried, and the territory which the concern proposes to work is Virginia, North Carolina, South Carolina, and portions of Tennessee, Kentucky and Georgia. Several salesmen will be put on the road at once and the territory worked thoroughly. The new enterprise is figuring on beginning business by November 15. The stock is now coming in, and it is hoped that everything will be in working order by that time. Mr. Binford states that the concern has excellent backing, although the authorized capital stock only amounts to $50,000. It is the idea of the organization to do a strictly jobbing business, and not cater in any way to the retail trade. Connections have been made with some of the largest manufacturers in the country for the handling of their lines in this territory. The company has adopted as its trademark a "red square" with a large "B" as the prominent feature of the escutcheon.

The Warren Electric Company is the name of the reorganized business which is being conducted by J. A. Dalby, H. W. Reaume and W. D. Warren, at 216 Pine Street, Trinidad, Colo. Mr. Dalby, who is a mechanical and steam engineer, has been chosen president. Mr. Reaume, who is an electrical and mechanical engineer, is manager, and will have charge of the electrical repair department, as well as the other electrical work. Mr. Warren, who has been made secretary and treasurer, will conduct the office and the purchasing end of the business on modern principles and with up-to-date methods. Mr. Warren has been with the old firm for the last ten years and has had much practical experience in electrical construction and in the supply business, in which he has been very successful. He is well known in the western section of the country, where he is usually referred to as "Bill" Warren. He is a member of the Order of the Rejuvenated Sons of Jove and is an associate member of the American Institute of Electrical Engineers.

LIGHTNING PROTECTION OF BUILDINGS.[1]

By Ernst J. Berg.

While little is known about the source of the electric energy manifested in lightning, fortunately, due mainly to the researches of Sir Oliver Lodge, a fair amount of knowledge exists about the nature of its discharge,—of lightning itself. Lodge first suggested that there are at least two distinct kinds of discharges: one which is relatively quiet and which results from the gradual breaking down of the air between the object struck and the charged cloud, the other which is a violent secondary discharge caused by a primary discharge in the vicinity.

The first kind follows the well known laws familiar to the electrical engineer, laws that deal with more or less permanent conditions. The nature of the discharge is governed by the resistance, inductance and capacity of the path. The path itself is almost certain to be the rod on account of the conducting streamers above it.

The second kind is more complex and the laws that it follows are less thoroughly understood. There is no conducting path above the rods because there may have been no potential difference between them and the surrounding air before the discharge. Thus the rods may well be missed and the discharge enter any portion of the roof and find its way to ground through the building. To guard against these it would seem that the entire roof should be of metal or at least largely covered by a metal network.

Electrical Constants of Lightning Rods.

It is generally recognized that a lightning discharge is oscillating and that the oscillations are of high frequency, perhaps from 100,000 to several million cycles per second. At these frequencies the electric constants of conductors are very different from those normally.

In the passing of high-frequency currents, energy is expended as heat at the surface of the conductor and in electric radiations in the surrounding space. The resistance, which depends upon the conductivity and the cross-section of the rod, is of no importance; even the shape of the conductor, which is of much importance with frequencies from 100 to 100,000 cycles, is of relatively little importance at frequencies from a million to ten million cycles.

The same applies to the inductance of the conductor; it is also practically independent of the kind of material or its section. It is evident from this that, provided the lightning discharge in the rod is a high-frequency oscillation, from an electrical point of view it matters really very little whether copper or iron, flat or round, stranded or solid conductors are used; though to be sure there is a slight advantage in flat ribbons, at all but the highest frequencies.

The object of the lightning rod is to form a path for the discharge, a path offering much less obstruction than any path through the building. If the resistance were all-important, this could well be done by using a very large copper rod, but at these very high frequencies the impedance is measured in tens or even hundreds of ohms, whereas the resistance may be but a small fraction of an ohm.

Electric Characteristics of Lightning Itself.

The greatest number of lightning discharges takes place inside of clouds or between adjacent clouds. These discharges involve usually rather moderate voltages, as has been shown by Steinmetz, but while very interesting are hardly within the scope of this paper. The knowledge of the nature of lightning discharges from cloud to earth is, however, of greatest importance in studying the efficiency of lightning rods. Unquestionably such discharges take place not only at moderate voltages, but also at voltages which are exceedingly high, the latter being the case when the charged cloud is separated from earth by a layer of more or less dry air.

Under these conditions the distribution of potential may be quite uniform and the air may, as a limiting case, be charged to its breakdown point all through its mass, when the potential difference may be exceedingly great, perhaps hundreds of millions of volts. The maximum value of the discharge current may also be very great, reaching several thousand if not hundred thousands of amperes, as may be judged from the consideration of the following simple and apparently conservative case. An area on the surface of the earth, 100 feet square, is subjected to the discharge of a cloud or part of a cloud also 100 feet square at a distance of 1,000 feet. In this case the capacity is approximately 0.000027 microfarad, a very small capacity indeed, something like that of the smallest Leyden jar. If the electric stress as assumed were uniformly distributed throughout the air space separating cloud and earth, and if the disruptive strength of air is 30,000 volts per centimeter, a potential of 912,000,000 volts would exist between cloud and earth just before the stroke. The electric charge, that is the amount of electricity stored, would be 0.025 coulomb, a very small value when considered by itself. The energy stored would, however, be great on account of the high difference of potential. It would be 11,200 kilowatt-seconds, corresponding to the energy of almost a pound of dynamite. This energy is expended in heat and electric radiation partly in the stroke before it reaches the rod, partly in the circuit of the rod. The higher the frequency, the greater is the relative amount radiated. With a small copper rod the energy radiated at one million cycles is perhaps 50 times as great as that converted to heat in the rod. With a small iron rod, however, the two quantities are not much different. Thus the iron rod will convert much more energy to heat and yet only slightly more impede the discharge. The number of oscillations of the current in the iron rod is, therefore, less than with copper and the discharge less violent. Whether, however, the energy is radiated or directly converted to heat is not so material. In either case the maximum current in the rod may be enormous and depends upon the frequency of the discharge. With an average lightning discharge this may be from 100,000 to perhaps 5,000,000 per second, in which case the maximum value of the current is from 15,000 to 750,000 amperes, it being proportional to the frequency. Steinmetz has shown that the impedance of the high-frequency conductor is about 0.1 ohm per foot at 100,000 cycles; 0.5 ohm per foot at 500,000 cycles; 1 ohm per foot at 1,000,000 cycles and 2.5 ohms per foot at 5,000,000. Thus the maximum drop of potential per foot of lightning rod would be 1,500 volts at 100,000 cycles; 9,000 volts at 250,000 cycles; 37,000 volts at 500,000 cycles; 150,00 volts at 1,000,000 cycles; and 1,880,000 volts at 5,000,000 cycles.

Were it permissible to consider that the frequency of the discharge is governed only by the electrical constants of the rod, this would mean about 5,000,000 cycles. If on the other hand the effect of the rod is hardly noticeable and the frequency is governed by the distance between cloud and earth, the frequency will be much lower, say 250,000 cycles, with a distance of 1,000 feet between the cloud and earth. In the first case the drop in potential per foot is about two million volts; in the second case only nine thousand volts.

The first case, I believe, gives an idea of the conditions of a secondary stroke. It is of very high frequency and may be the result of the discharge of the air immediately surrounding the rod rather than the entire air between cloud and earth. The discharge area is in that case difficult to estimate; it may be quite limited or it may be quite great. Assuming again an area 100 feet square and calculating the voltage and capacity, it is found that the capacity

1 Address at convention of Illinois State Electric Association, Peoria, Ill., October 24, 1912; slightly abridged.

is increased in the same proportion as the voltage is decreased, therefore the charge and maximum value of the current remains unchanged. The maximum value of the current would be, say, 750,000 amperes and the drop per foot of rod about 2,000,000 volts. It is evident that such discharge would rather jump several feet in the air than to travel one foot in the conductor. (The drop in potential of 2,000,000 volts per foot corresponds to two feet striking distance between parallel planes and perhaps 10 feet distance between projecting masses of metal.)

The second case, I believe, is approached when a lightning discharge takes place from cloud to rod after a conducting path has been prepared by means of streamers. It is the first, the quiet type of lightning mentioned in the beginning of the paper.

Thus is seen how a single lightning rod may be expected to take care of low-frequency discharge from cloud to earth, but is entirely inadequate to cope with a violent secondary discharge even if perchance it hits the rod instead of the building proper.

Were this illustration then at all representative it would mean that one lightning rod, while offering some protection, is entirely inadequate to cope with the situation. If the building were grounded by ten rods the condition would be much improved, the maximum drop per foot would then correspond to a moderate air space and the lightning discharge would probably be confined to the system of rods.

Before discussing the approximations involved in this elementary discussion, it may be well to see the effect of a larger cloud, or perhaps better a larger section of a cloud discharging through the rods. If the areas were doubled, twice as many rods would be required for the same amount of protection. If the areas were the same but the cloud were only one-half as far above the building, the voltage would be lower but the capacity greater, and the conditions in the original assumption would apply.

Principal Uncertainties in the Theory.

The principal uncertainty of this theory lies in the estimate of voltage and frequency. Regarding the voltage, it is not likely that even in perfectly dry air the electric stress is uniformly distributed through the space; it is probably higher at the cloud and at the building than in the column of air separating them. The effect of this would be to lower the voltage and therefore the charge and energy involved. It is probable that, as stated previously, in discharges in clouds and between clouds the voltage may be only moderate, because it is likely that the discharge takes place from drop to drop at rather low values. In the case of the discharge to ground, however, this suggestion does not seem reasonable, when the lightning strikes through clear air. Furthermore, unless the voltage is extremely high, the energy discharged could not be great enough to do what is frequently done.

Regarding the frequency a great deal has already been said. It seems reasonable that discharges take place of as low frequency as 100,000 cycles and as high as several millions. While with the former a considerable amount more of energy is likely to be involved, it seems reasonable to expect that a rod is of very considerable protection, whereas with the latter a very large number of rods would be required.

Conclusions.

What conclusions can then be drawn regarding the best method of protection?

Is there any real advantage in the installation of lightning rods, or do they draw lightning and thereby add to the danger?—Experience seems to have settled beyond reasonable doubt that if properly installed lightning rods afford considerable protection. A large number of instances might be quoted, but suffice it here to mention only one near at hand. Before equipping the buildings of the University of Illinois with rods, three fires were caused by lightning; since that time, though the number of buildings is greatly increased, there has been do danger from lightning. Any lightning rod "draws" lightning if by that expression is meant that it prepares under certain conditions an easier path for the lightning discharge than would be the case if it were not there. The conducting streamers issuing from the rod tend to equalize the potential between earth and cloud and thus diminish the severity of a stroke and possibly prevent it altogether. Yet it may also be argued that unless there are many such streamers the rod cannot always cope with the situation and a stroke may result from them. This feature is dealt with later under another heading.

Can a building be perfectly protected from lightning?—The answer must be no, except perhaps in the case of a thoroughly grounded all-metal building.

How much protection does a lightning rod afford?—Unquestionably some if properly installed, but it may make matters worse in some cases. Assume for instance that a large building is equipped with a high but broken rod or a rod having poor joints or a high resistance to ground, say several hundred ohms, which undoubtedly sometimes is the case. Such rod could serve the function of equalizing the potential between cloud and earth almost as effectively as a good rod, and were there only a sufficient number of them it is conceivable that the neutralization of potential would be so complete as to make a flash discharge practically impossible. A building having one rod only is, however, considered at present. The rod is assumed as projecting considerably above the building. If the electric tension is great, unquestionably streamers are being emitted, the air above the rod is made fairly conductive and thus the discharge is invited. The question is then: How can such rod take care of a discharge? It has been shown how the discharge current frequently is very large, and while the resistance of the rod is practically immaterial as long as it is at all reasonable, it must not approach or exceed the normal value of the impedance. In a rod, say, 30 feet long the resistance of even the smallest practical iron conductor is a fraction of an ohm only, and the impedance is perhaps 30 to 75 ohms, depending upon the height and the frequency of the discharge. It is easily seen that a poor joint may have many times this resistance; therefore, when the discharge encouraged by the streamers from the defective rod strikes the building it finds the rod entirely inadequate to cope with the situation. The voltage drop in the rod is so great that it is far easier for the current to split up in a number of paths and enter through the building than to confine itself to the rod. The apparent paradox thus exists. The rod should have good joints, should have good ground connection and should be mechanically secure against breaking, although the shape of the rod, its metal or general dimensions are rather immaterial.

How many rods should be used?—The answer is: the more the better. The protection afforded ought to be, roughly speaking, proportional to the number of earthed rods. A half dozen ground connections to a house 100 by 50 feet seems nothing out of the way.

How should they be placed?—They should always be placed outside of the building and it is indeed a question whether the vertical part of the system, that is the rod proper, should not be some little distance from the wall and possibly even insulated therefrom. The rods should be a considerable distance from gas pipes, stove pipes, water pipes and balconies or places where persons might be during the storm. A small house might be protected by five ground connections, one at each corner and one from the chimney. A horizontal rod may be run along the ridge of the roof and connected to earth by the five ground connections. Heated gases coming from a chimney are apparently themselves good conductors or more probably are instrumental in collecting and forming a conducting path of charged particles constituting good conductors for lightning

discharges. It seems conservative, therefore, to have a metal conductor crossing over the chimney opening. Such conductor should be made of copper on account of the chemical effect of fuel gases on iron. Two small spires, each having many points, are used. These are unquestionably of some advantage in that through them there is a continuous equalization of the potential between cloud and earth. It seems, however, as if their height should be moderate. A projection of a few feet seems quite enough. To be effective in their office, these spires should have several points but the expense of using platinum or something similar seems hardly warranted, because the amount of current discharged from the points is insignificant before the "brush discharge" begins, and when such discharge takes place it matters little whether the points are rough or sharp. Each tower or other projection of a building should have direct ground connection, though connected with the other lightning-rod system.

It is unsatisfactory to connect a small dormer, supposedly protected by an independent short rod, by a long wire to the main system. It seems unlikely that the discharge will travel many feet to reach the main rod when by striking through the building it can reach ground in most cases with greater ease. The attic room, thus supposedly protected, is in my opinion endangered by the rod. Protection would, however, result if the dormer rod were directly grounded. Metal gutters should be connected to the lightning-rod system and should be connected at their lower extremities to ground. A high factory or power-plant chimney needs good protection; two or three rods do not seem too much and the opening of the chimney should be crowned by some simple copper-rod construction.

What kind of material should be used?—In cities where, after all, the damage by lightning is small, where there is always more or less fuel gases and soot in the air, copper seems best. But I can see no electrical advantage in having a stranded cable; a solid rod is as efficient. In the country galvanized-iron rods seem best for two reasons. First, they are cheaper; second, their electrical constants are if anything better than those of copper. Again an apparent paradox is met. It has been said that the material, size and shape of the rod was rather immaterial and yet now iron rods are recommended. The reason is that the first statement applied to the ability of the rod to discharge the current with the least drop of potential, whereas other factors also enter, factors which, to be sure, are of secondary importance.

The old idea that the rod carries the electric charge to earth and that that is the end of it, is fallacious. The earth is one plate of the condenser, the cloud the other, and whatever energy is stored between them has to be consumed in some way. It is done by heating the rod and by sending out electric radiations. The higher the resistance of the rod the greater is the energy converted to heat, thus the smaller are the number of oscillations of the discharge current necessary to dissipate the energy. Iron has considerably higher effective resistance than copper, thus iron has an advantage. Perhaps the point will be clearer by stating that as far as impeding the flow of the current is concerned, the resistance of the rod is immaterial as long as it is at all reasonable; as far as affecting the duration of the discharge is concerned, however, the higher the resistance the shorter is the time and the less violent is the disturbance.

What should be the shape and size of the rods?—While flat conductors have a very slight advantage it appears too small to be considered seriously. A round wire or a pipe can conveniently be handled and seems therefore preferable. In the installation of the rods, sharp bends should be avoided as much as possible. There is little or no advantage in using large expensive copper conductors or cables; a size mechanically satisfactory is likely to serve all electrical purposes. Expensive sharp points offer little advantage over ordinary rather blunt points. The rods may advantageously terminate in a number of points projecting only a short distance above the part to be protected.

How should ground connections be made?—They should be of low resistance, therefore, the rods should preferably terminate in moist soil. "Salting" the ground may be an advantage, but the experience with such ground is not sufficient to warrant its adoption unless an occasional inspection is made. In many cases excellent connection can be made by driving a galvanized gas pipe a few feet in the ground.

Should water, steam and gas pipes in the building be connected to the rods and grounded?—This is debatable; on the whole it would seem most conservative to leave them alone, especially the gas pipes. The water pipes, which are always grounded, may, however, advantageously be connected to the lightning-rod system underground.

Is it dangerous to stand in a draft during a thunderstorm?—Certainly a building having its windows and doors open affords a chance for the entrance of air, perhaps ionized air made conducting by a previous discharge. Thus it is safer to keep the house closed during a violent storm.

Is it safe to stand near a lightning rod?—From the preceding discussion this seems hardly safe. It is well to keep away not only from the rod but from chimneys, kitchen ranges, metal pipes, etc.

It is finally of interest to draw attention to the fact that the damage by lightning in cities is relatively small and that so far the modern sky-scraper with its vast amount of steel appears to be lightning-proof.

In conclusion, I wish to emphasize the fact that we know after all little about lightning. I have tried to incorporate the experience of many investigators and observers and am particularly indebted to Sir Oliver Lodge's numerous writings and experiments on this subject.

Civil Service Examinations.

The United States Civil Service Commission announces an examination for mechanical draftsman on November 25. Appointment will be made in the Immigration Service at New York City and elsewhere as vacancies may occur at the rate of $5.00 to $6.00 per day. Applicants should be qualified to draw plans and specifications for steam heating, plumbing and electric wiring, and be qualified to inspect and test installations of these kinds. They should have at least five years of experience as inspector and five years as draftsman. Applicants will be rated upon education, training and experience, and no written examinations will be held. Form 1312 should be secured and filled out by applicants.

An examination for architectural draftsman will be held on the same date and under the same conditions.

An examination will be held on December 4 for the position of aid in the Bureau of Standards, Washington, D. C., at salaries of $600 and $720 per annum. The examination will cover elementary algebra, geography and trigonometry, general physics and elementary mechanical drawing. Education and experience will also count largely in the credits.

Best Composition for Silicon Steel.

At the International Congress for Testing Materials a paper entitled, "Note on the Magnetic Properties of Dynamo Sheet," was presented by De-Nolly and Veyret, in which they described attempts to determine the kind of steel and the method of treatment which would give the best sheets, with respect to permeability and energy loss due to hysteresis and eddy currents. They recommended the use of a steel containing less than 0.1 per cent of carbon, less than 0.3 per cent of manganese, less than 0.03 per cent of sulphur and phosphorus, and from 3 to 4 per cent of silicon. The sheets should be rolled finally at a low temperature and afterwards annealed between 750 and 800 degrees centigrade and not subsequently worked cold.

LETTER TO THE EDITOR.

A Correction.

To the Editor:

My attention has just been called to a typographical error which occurred in the paper entitled "Luminous Intensity and Energy Relations in Incandescent Lamps," published in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, November 25, 1911.

The last set of equations on page 1092 is printed with the following values of the exponent of (W_0/W) : — 4.48, — 5 and — 7.32. The values of this exponent should be 1/4.48, 1/5 and 1/7.32, so that the correct equations are:

For carbon,

$$I = I_0 e^{12.14\,[1-(W_0/W)^{1/4.48}]}$$

For tantalum,

$$I = I_0 e^{11.45\,[1-(W_0/W)^{\frac{1}{5}}]}$$

For tungsten,

$$I = I_0 e^{16.48\,[1-(W_0/W)^{1/7.32}]}$$

FRANCIS E. CADY.

Cleveland, O., November 8, 1912.

Copper Production and Consumption.

According to statistics recently compiled, the production of copper does not appear to keep pace with the consumption. In Germany the consumption is on the increase, but in the United States there appears to be a slight reduction as far as last year was concerned.

The world's production and consumption of copper during the last three years are given in the following table:

	World's Production. Tons.	World's Consumption. Tons.
1909	839,425	828,739
1910	855,685	933,290
1911	873,460	986,300

Reserve stocks of some 175,000 tons have hitherto met the excessive demand, but these accumulated stocks have now been reduced to considerably less than half that quantity. As far as Germany is concerned, the consumption of copper by the various branches of the industries concerned was as follows:

	1911. Tons.	1910. Tons.	1909. Tons.
Electrotechnical industries	110,000	103,000	90,000
Copper rolling mills	42,000	40,000	38,000
Brass works	59,000	43,000	41,000
Chemical industry	3,000	2,500	2,000
Shipbuilding, railways, etc.	25,000	23,500	23,500
	239,000	212,000	194,500

The aggregate production of copper for various countries during the last three years has been as follows:

	1911. Tons.	1910. Tons.	1909. Tons.
Australia	41,840	40,315	34,400
Canada	24,930	25,715	24,105
Chili	29,595	35,235	35,785
Germany	22,010	24,710	22,455
Japan	55,000	46,000	47,000
Mexico	54,030	61,515	56,325
Peru	25,445	18,305	16,000
Russia	25,570	22,310	17,750
Spain and Portugal	52,045	50,255	52,585
United States	492,650	484,935	490,280

The Melting Point of Tantalum.

A new determination of the melting point of tantalum has been made by Pirani and Meyer and reported in a recent communication to the Deutsche Physikalische Gesellschaft. The value found is 2,850 degrees centigrade, which is closer to the previous measurement of the same experimenters than was expected, as the latter was supposed to involve serious errors.

Two methods were employed. In the first a strip of tantalum one millimeter in width, 0.04 milimeter in thickness and 100 millimeters long was suspended in an evacuated glass bulb, the maximum pressure amounting to 0.005 millimeters of mercury. This constituted a tantalum lamp. After preliminary measurements, in which the temperature scale was extended up to 2,000 degrees by measurements of the radiation from the blackened bulb acting as a black body, the current was increased until the ribbon melted. Calculations made on the basis of the loss of radiation then gave the temperature. As the ribbon was suspended vertically it was possible that it was strained by its own weight and gave way before the melting point was reached; consequently a second method was tried.

A wire one millimeter in thickness was made the anode of a mercury arc, whose intensity was increased until the point of the wire melted into a bead. This was easily observed. This method gave somewhat higher values.

The temperature coefficient of resistance was also observed by the first method. Proportionality with temperature was found to exist up to 2,800 degrees, the measurements being in agreement with those previously obtained through the range of temperature from liquid air to 1,800 degrees.

Smallest Central Station in United States.

The town of Sacramento, Neb., has a total population of a dozen inhabitants. However, Sacramento is progressive, as evidenced by the fact that it already has a central station. E. G. Anderson, proprietor of this embryo lighting company operates a three-horsepower Fairbanks-Morse coal-oil engine. His total connected load consists of 30 tantalum lamps.

America Leads in Coal.

Since 1899, when the United States supplanted Great Britain, this country has held first place among the coal-producing countries of the world. In 1911 the total world's production of coal amounted to approximately 1,300,000,000 short tons, of which the United States contributed 496,221,168 tons, or 38.1 per cent.

Electrolytic Action On Unreinforced Concrete.

In a paper before the International Association for Testing Materials, Cyril de Wyrall, of the Interborough Rapid Transit Company, New York City, cited observations indicating the destruction of plain concrete by electric currents.

Four years ago an inspection was made of a concrete wall, which was erected in 1902. This wall, which carried no load, is below tide level, is three feet thick, and is made of 1:2:4 mixture of cement, sand and trap rock. It was placed with care and under competent superintendence. The examination showed a disintegration to such an extent that the surface was practically mush. A year later another examination was made, and large sections, from 4 to 6 inches thick, which crumbled in the hands, could be pulled off the face. Last year still further deterioration was found to be in progress, and a chisel could be driven 12 inches into the wall by hand alone. A voltmeter test showed 11 volts difference in pressure between the extremities of the structure.

This is not an isolated case. There is an exact duplicate in almost every particular, except that the second structure was erected a year later and different brands of cement were used. In the summer of 1911 an inspection was made of some concrete tunnels and bridges erected by three different railroads entering New York. This work had been only recently finished. Each of the railroads had its own cement laboratory, and the different brands of cement used were rigidly tested. The structures are all above tide level, and wet only in spots. Where the concrete is wet, from one to five volts was found, and the concrete is deteriorating, though not as much as in the former instance. Where the concrete is dry no voltage was found and the concrete is in excellent shape; this occurs in the same tunnel, the concrete apparently being the same mixture and placed at the same time. It seems to make no difference whether the concrete was placed in cold or warm weather; deterioration goes on just the same, the only difference being between the wet and dry places.

It is a known fact, although wet concrete is an excellent conductor, dry concrete is practically a non-conductor. The combination of electric current and water seems to act as a disintegrating agent on the cement, destroying its cohesion and reducing it to a paste, which when dried can be pulverized with the fingers.

One efficient means of preventing the damage is to waterproof thoroughly all parts of a concrete structure that is surrounded by earth. Such protection acts in two ways; it keeps the structure dry and it insulates against any possible electric currents.

A PRECISION PHOTOMETER BENCH AND ACCESSORIES.

By Edward P. Hyde and F. E. Cady.[1]

During the past decade there has been a notable advance in the precision of photometric measurements. Sources of error which were formerly considered insignificant are now carefully guarded against and as far as possible removed. Before the adoption of incandescent lamps as secondary standards of light, the uncertainties in reproduction of existing standards were large enough to make many errors relatively negligible. Formerly those engaged in producing artificial light sources were more interested in the uniformity of the physical characteristics of their output than in the accuracy of its rating. But gradually progress in the latter has demanded progress in its method of accomplishment.

On the other hand, there has been a decided growth in the use of photometry for the solution of certain scientific problems, a growth which may perhaps be traced at least in part to the increased precision in photometric methods and apparatus. It was a desire to push this precision a little further, if possible, which led to the design and construction of the photometer bench described in the following paragraphs.

The effort to reduce the uncertainty in the measurement of light sources was initially directed toward the improvement of the photometer, or more properly the photometer head, which includes the disk and the optical system used in viewing it. Thus, the Leeson disk form of Bunsen or "grease-spot" photometer was a big improvement over its predecessors and the Lummer-Brodhun contrast photometer marked another step in advance.

While it is true that the photometer head is the most important factor in the photometric equipment, it is very necessary that the remainder should fulfill certain requirements. In the case of gas measurements the arrangements for measuring and controlling the flow of gas, and in the case of incandescent electric lamps, the apparatus for determining the voltage and current, are very important accessories. The bench itself on which the photometer head runs may be an unsuspected cause of small errors or even large ones.

Among the possible sources of error in the photometer bench may be mentioned the following: lack of straitness in the ways or lack of parallelism in a horizontal plane. These may introduce uncertainty in the distance measurements. The lack of parallelism may be due to weakness in the supporting frame, to poor initial construction, or to wear. The photometer scale may not be accurate. If it is etched on one of the ways, as is the case in some benches, it is subjected to change if the ways become distorted. Again, the screening system may not be adequate to protect the photometer disk from extraneous light.

It should be emphasized that the above sources of error may have no significance except in cases where extreme accuracy is desired, and while it is true that they can be allowed for, it is nevertheless desirable to avoid them if possible, particularly if the bench is to be used for purposes of investigation rather than for ordinary testing.

Aside from the question of accuracy, the matter of convenience should be taken into account in the design of a photometer bench. Thus the operator should be able without difficulty to reach the photometer head at any position on the ways. And similarly the lamp holders should be easily accessible. The ease of motion of the photometer-head carriage is important, and the screening system should be capable of quick adjustment. If a rotary lamp holder is employed, the speed adjust-

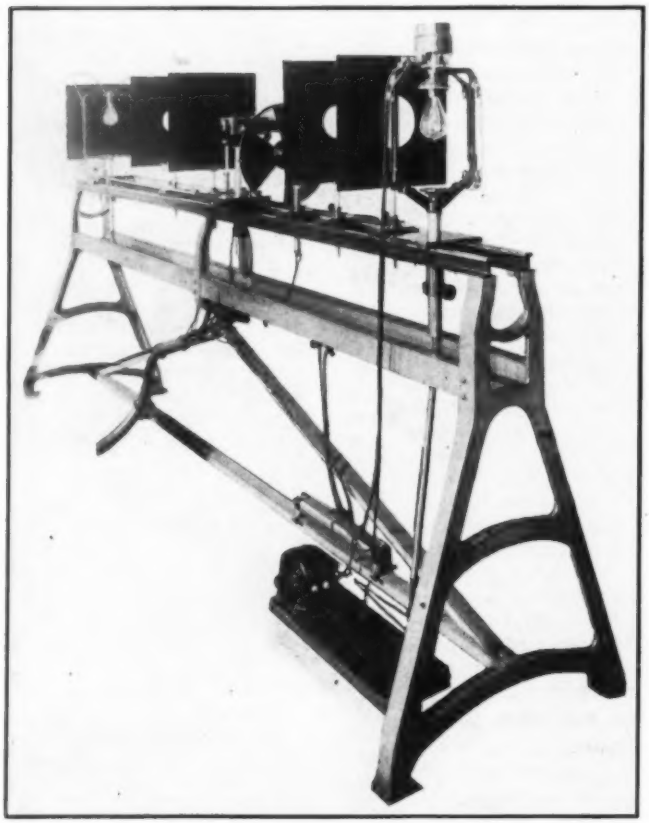


Fig. 1.—Photometer Bench.

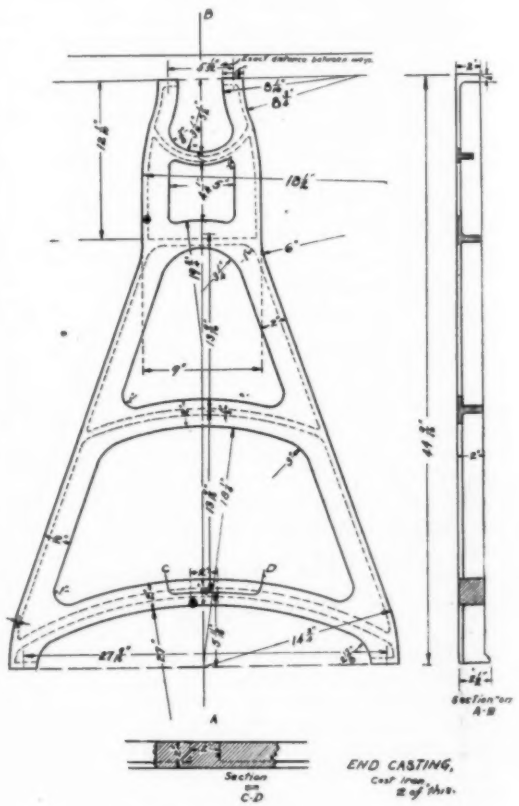


Fig. 2.—End Casting.

1 Physical Laboratory, National Electric Lamp Association.

ment should be simple and should cover an adequate range, and, in the case of electrical measurements, the contacts should be positive.

The photometer bench shown in Fig. 1[2] was designed as a result of some five years of experience in the photometric section of the Bureau of Standards at Washington. While it is essentially a precision photometer bench, some features may be of interest in commercial work.

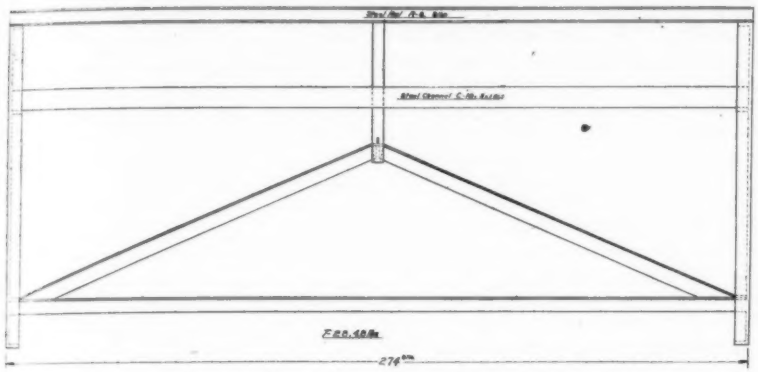


Fig. 3.—Side Elevation.

The frame is of iron cast in two end pieces and one center piece, supported and connected by iron T-beams and channels. Fig. 2 shows the end castings, and Fig. 3 is a side elevation of the supporting framework. The result is a heavy, strong and very rigid framework. On this are mounted the ways, which are T-rails, carefully straightened. They are planed on the top and sides, giving a flat bearing surface. Some difficulty was experienced in planing these rails, and better results could probably be obtained by grinding. The principal advantages of this type of track are the ease with which the surface can be checked as to its straitness and planeness, and the simplicity of the wheel design required for a strait-line motion. The wheels have a horizontal bearing surface with beveled flanges, the width of the bearing surface being the width of the rail surface with the least possible clearance. This refers to the two front wheels only. The back-wheel bearing surface is somewhat wider than the rail. If then the surfaces of the two rails are in the same horizontal plane, and the front rail edges are parallel strait lines, the carriage will run in a strait line.

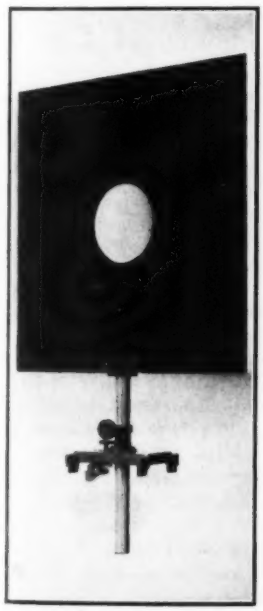


Fig. 4.—Movable Screen.

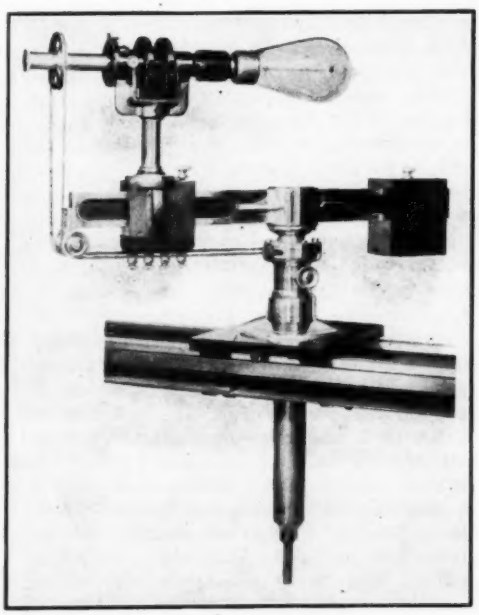


Fig. 5.—Universal Rotator.

The photometer-head carriage is provided with four removable screens. On one side are sleeves into which are clamped the rods for connecting this carriage to the lamp carriage on that side, which is fitted with similar sleeves, all working with universal joints. This eliminates the possiblity of friction due to slight irregularities in the ways. This carriage has a rack and pinion for the vertical adjustment of the photometer head. The pointer showing the scale reading is made in two parts having a lateral motion with respect to each other and provided with a vernier. In this way any initial difference between the position of the photometer screen and the mark on the pointer with reference to the scale, may be allowed for. Furthermore any other constant distance error may be taken into account. The pointer and scale are illuminated when desired by a miniature lamp placed just above them, controlled from above by a button. The carriage and connections are moved by a knurled wheel fastened to an extension of one of the front-wheel axles. Motion is obtained through friction only. The two front wheels are connected by an endless cord, giving a greater traction.

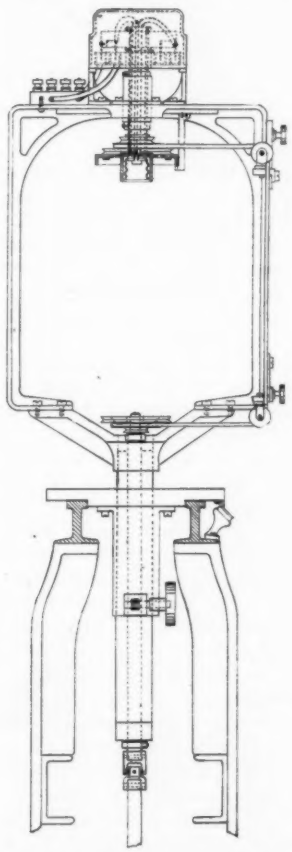


Fig. 6.—Standard Lamp Holder.

The type of flat surface track permits the use of a very convenient form of support for the movable screens, shown in Fig. 4. The screens are easily

2 In order to facilitate inspection a portion of the screening system has been removed.

adjusted horizontally or vertically and as easily clamped in a fixed position or removed. The jaw of the clamp is forced against the under side of the rail by a screw operated from the top of the holder, and falls by gravity when released.

The lamp holders have been designed with the general idea that one shall be used for taking standards and sources to be measured, the other for an intermediary or comparison source. The latter is therefore provided with means for turning about a vertical axis, but cannot be continuously rotated. The side uprights are slotted, permitting an estimation of the relation between the center of radiation and the carriage pointer giving the distance reading.

The other, or standard lamp holder, is similar in outline but is equipped with a mechanism giving rotation about a vertical axis. Since this holder is not moved much, it is not mounted on wheels, but has flat bearing surfaces with flanges so that it slides along the ways, or may be fixed in position by two clamps. A detail drawing of this holder and rotator is shown in Fig. 6. It is driven by a one-eighth-horsepower motor, located on the floor below, through a set of speed pulleys and a telescoping shaft with universal joints. These pulleys together with those on the rotator give a set of speeds ranging from 40 to about 600 revolutions per minute. A rheostat in the motor circuit permits of fine adjustment of the speed. The electrical connections are made through mercury cups which are quite deep and covered with a cap to shut out dust.

For use in the intercomparison of standard lamps, where it is necessary to avoid any possible error owing to contact resistance, it is well to have the test socket "split," that is, to have the shell divided into two insulated parts and the bottom composed of a ring and plunger insulated from each other. By connecting the current leads to one side of the shell and to the ring, and the potential leads to the plunger and to the other side of the shell, practically all contact errors between the lamps and the socket are eliminated. Such a construction involves the use of four mercury cups. In the majority of cases these contact errors either do not enter at all, or are wholly negligible, and in the rotator shown in the figure, current and potential leads are carried to the two mercury cups which in turn are connected to the side and base of the socket. The current leads have a large carrying capacity and the potential drop between the mercury cups and the socket is small, but may be allowed for if desired.

One advantage of this rotator is its great rigidity. Even at the highest speed of rotation practically no vibration is perceptible at the photometer head.

As indicated, the standard lamp holder may be used to measure the mean horizontal candlepower or the distribution in the horizontal plane. If the distribution in a vertical plane is desired, this lamp holder is replaced by a universal rotator shown in Fig. 5. This is an improved form of the rotator designed by one of the authors and made and used at the Bureau of Standards, a description of which was published in the *Bulletin of the Bureau of Standards*, Vol. IV, page 93. The improvements consist mainly in the method of driving and of support. The present instrument is mounted on a carriage of its own and provided with a central driving shaft which can be directly connected with the telescoping shaft used to drive the regular lamp holder, the latter having been disconnected. A large central cone bearing forms the main support and eliminates any possibility of lateral motion. This cone bearing is hollow and traversed by the driving shaft, which terminates in a pulley. The chamber in which the pulley rotates is so rounded that there is no trouble in case of a loose belt or in the insertion of a new one. The result of the above modifications is to give a considerable increase in stability and in the simplicity of operation.

With the exception of the universal rotator the apparatus mentioned in the preceding paragraphs has been in use for two years and has been found to be very satisfactory. It is hoped that this description will be of some interest to those desiring precision apparatus of this character.

Electrolytic Copper Refining in Norway.

By the development of a new process of electrolytic copper refining invented by Victor Hybinethe, a Norwegian engineer, much refractory and low-grade copper ore mined in Norway has been made available for profitable working into pure copper. The treatment, which is done at the mine and thus results in enormous shipping economies, consists in leaching the crushed ore with a solution of sulphuric acid which dissolves out the copper; a strong current of electricity is then passed through this solution and the pure copper is deposited. Much Norwegian ore was formerly shipped to Germany and Sweden, owing to the lack of proper Norwegian reduction works, but of late some of the companies have not been able to mine with any profit by this plan because of the low price of copper and the high costs of transportation.

BOOK REVIEWS.

"The Elements of Structures." By George A. Hool. New York: McGraw-Hill Book Company. Cloth, 188 pages (6 x 9 inches), illustrated. Supplied by the Electrical Review Publishing Company for $1.75.

This book is prepared for correspondence study, being one of a series of books used by the Extension Division of the University of Wisconsin. The work presupposes a knowledge of arithmetic, algebra, plane and solid geometry, logarithms, trigonometry, mechanical drawing and strength of materials. That mechanics is not mentioned seems strange, as the work of this course could be done with so much greater facility with this preparation. The book is written in articles of one or more paragraphs each and these form chapters which are, in turn, a part of or are subdivisions of assignments. The assignments are each followed by a list of problems of a practical nature. The illustrations are well prepared and seem in most cases ample for the needs of the book.

The book does not strike one as being quite full enough for home study. Thus in the matter of Cooper's standard train loadings the designations should be made more clearly. The matters of equivalent load and excess panel loads do not receive full enough consideration. The discussion of moments of forces is not full enough and needs some further illustrations near the body of the text where this discussion takes place. The use of amount of motion as a measure of the moment of a couple is not good. Amount of motion is a function of time as well as moment. This idea is not conveyed in the text. This point demands explanation to the home student. Again it seems that the proof of the parallelogram of velocities should precede the use of the force triangle and that the discussion of equilibrium should be fuller for beginners. The elementary application of the force triangle to the solution of problems and the use of graphics to give analytical relations is excellently indicated at the end of the third assignment.

After discussing structures, their classification and the methods of loading, the author discusses forces, force polygons, moments, equilibrium and the equilibrium polygon and follows this by the determination of reactions. This work is well illustrated by solved problems and problems to be computed, using the graphical method as well as analytical methods. The use of influence lines is well illustrated by a great number of problems.

The concentrated load system with its moment table is explained well and

applied to a number of well chosen problems to find maximum values of shear or moment. The various criteria for these are given. The effect of floor beams is made evident. The graphical determination of the maximum value is explained. The use of equilibrium polygons in this solution is made clear.

The stresses in truss members are treated analytically and graphically, but it is regretted that there are not several typical roof and bridge trusses with and without wind load. The reference at another place to a complete treatment in another textbook is criticised as the book should be complete in itself.

There is one chapter on the design of truss members followed by an excellent chapter on the use of steel handbooks, using the Cambria handbook as an example. The author explains the various tables in this book, using problems to illustrate the application of them. The tables are checked and the methods of computing them explained. Problems for the student to solve insure a knowledge of the use of the table. A short chapter on the structural shop, explaining the work done there, closes the book.

The book is well written and, save for the lack of fullness at one or two places and for the absence of several complete truss analyses for roofs and bridges, it is well adapted to its purpose. It should make a good class room textbook, where a short course is required.

ARTHUR M. GREENE, JR.

"Alternating-Current Design." By Julius Frith. New York: D. Van Nostrand Company. Cloth, 118 pages (5½ x8½ inches), 27 illustrations. Supplied by the Electrical Review Publishing Company for $2.00.

It has often been stated that dynamo design is an art rather than a science. Unfortunately this has been too nearly true in the past; but the designing engineer who today wishes to achieve distinction, to do more than routine work, must be ready to carry scientific methods and scientific analysis further and further into his work. It is therefore to be regretted that an author with Mr. Frith's facility for simple, clear exposition, should have assummed, slurred over, or treated as negligible, many factors which, though in some cases of minor importance or capable of fair approximation without computation, are in some other cases of major importance and capable of rational determination. For example, on page 55 an average value of 0.85 for the slot-opening contraction-factor is assumed, without any suggestion of the wide range of variation of this factor or of how to compute it. Similarly this slot contraction is neglected altogether in figuring the zigzag leakage. Finally, the values of many of the design constants are assumed without any explanation as to their range or limits. There are also several inaccurate statements, usually given without explanation; for example, that the number of slots per pole per phase should be a whole number in both alternator and induction motor. This is not only not necessary, but in the case of alternators it is frequently undesirable, on the score of wave shape, particularly where the number in question is small. On page 16 the flux per ampere-inch of slot is given as from 50 to 100 lines (or maxwells); this is probably a typographical error, as it is several times too large.

The statement made in the first paragraph on page 52 to the effect that an 80-per-cent-power-factor induction motor will have a breakdown torque less than half that of a motor with the same output and 90-per-cent power-factor is very misleading, unless further qualified. For example, starting with a short air gap and nearly closed slots, an increase of either or both will in general decrease the maximum power-factor and at the same time increase the maximum or breakdown torque instead of decreasing it. The statement above referred to is thus a fair sample of the danger of short-cut methods; the method used by the author taking no account of slot openings except to assume an average.

The method of design outlined by the author, supplemented by large experience, would doubtless yield fair results when applied to some familiar type of machine, but would be decidedly dangerous, when applied to the design of some special machine requiring unusual proportions, even when in the hands of an experienced designing engineer. This conclusion has been borne out again and again within the writer's own experience.

As a textbook for students it is dangerous unless supplemented by many danger signs, in that it tends to cultivate the habit of assuming or guessing at design constants or proportions which are pretty definitely determinable on a rational or scientific basis. An experienced designing engineer can and frequently does take short-cuts, without danger, but it is never safe in an unknown country; the risk is too great. The student should be taught to think first; even though it may be the "long way around," it is likely to be much "the shortest way home."

The book is written in a pleasing narrative style without headings other than chapter headings. For a person well grounded in the subject there are several suggestive points of view; e. g. the method of dealing with the various fluxes in an alternator is particularly clear. For persons unfamiliar with the subject, the book, if provided with a few danger signals, would give an excellent introductory bird's-eye view of the field, throwing the principal features into relief and reducing everything to its lowest terms. In fact the author shows unusual skill in exposition.

C. A. ADAMS.

"Precis de Télégraphie Sans Fil." By J. Zenneck. Translated from German to French by P. Blanchin, G. Guérard and E. Picot. Paris: Gauthier-Villars. Paper, 381 pages (6½x10 inches), illustrated. Supplied by the Electrical Review Publishing Company for $2.50.

This book is a translation of Zenneck's *"Leitfaden der Drahtlosen Telegraphie,"* and is complementary of *"Les Oscillations Electromagnétiques et la Télégraphie sans Fil,"* which is a translation of *"Elektromagnetische Schwingungen und Drahtlose Telegraphie"* also by Zenneck. The *"Précis de Télégraphie sans Fil"* contains twelve chapters devoted respectively to (I) The free oscillations of a condenser circuit; (II) Open oscillators; (III) The circuit of high-frequency alternating current; (IV) Coupled systems; (V) Resonance curves; (VI) The antenna; (VII) Transmitter for damped oscillations; (VIII) Transmitter for excitation by impulse and by undamped oscillations; (IX) The propagation of waves along the surface of the earth; (X) Detectors; (XI) The receiving apparatus; (XII) Directed telegraphy.

The first chapter, in addition to giving the methods of measuring and calculating frequency of condenser discharge, presents also a careful discussion of the decrement due to Joulean heat, to condenser losses by brush discharge and by hysteresis, and to losses of energy in the discharge gap. Chapter II contains a description of the fundamental and harmonic vibrations of linear oscillators, and a discussion of the electromagnetic field surrounding the oscillator.

Chapter III and accompanying tables gives a discussion of high-frequency resistance and inductance of conductors and a comparison of the sensitiveness of different methods of measuring oscillatory currents. Chapter IV contains a brief discussion, accompanied by formulas, of the general fundamental properties of coupled circuits appropriate to the transmitting station. Chapter V presents a good collection of theoretical and experimental application of wave-metrical methods to the determination of damping in simple and coupled circuits with and without spark gaps in circuit. Chapter VI contains a description of several principal types of antennae, and a discussion of the action of condensers and inductances in shortening and lengthening the

period of oscillation, together with a brief treatment of the influence of the ground on the characteristics of the oscillation. There is in this chapter also a brief summary of usually accepted decrements of the different types of antenna.

Chapters VII and VIII contain interesting details regarding, in particular, the mode of action of arcs in exciting undamped oscillations. Wireless telephony employing copper-carbon arcs for excitation is also described in one of these chapters. Chapter IX contains a comprehensive survey of the remarkable period of oscillation, together with a brief theoretical work of Dr. Zenneck on the manner in which the electric waves are propagated over the surface of the earth, together with many interesting curves showing the effects of different kinds of soils on transmission distance. Chapters X and XI contain a brief discussion of detectors and details of circuits for the receiving installation. A photographic registering apparatus making use of an Einthoven string galvanometer and several forms of tuning apparatus are shown in half-tone illustration. The account of directed wireless telegraphy in Chapter XII contains descriptions of methods using Marconi's horizontal antenna, Blondel's double antenna at half-wave distance apart, Braun's multiple antenna of different phase, and the radiogoniometer of Bellini and Tosi. A brief account is also given of Zenneck's experiments in the attempt to use screens or reflectors in directing the waves. The book is concluded by Tables, Addenda, and Notes.

The treatment throughout the book is non-mathematical, but many of the results obtained by mathematics are presented with the aid of curves and formulas. The notation in the translation is somewhat modified from the German original so as to accord with French usage, and this is an advantage for American readers, since the French notation is generally nearer to American usage than is the corresponding German notation.

GEORGE W. PIERCE.

"Elements of Drawing." By George F. Blessing and Lewis A. Darling. New York: John Wiley & Sons. Cloth, 193 pages (6 x 9 inches), illustrated. Supplied by the Electrical Review Publishing Company for $1.50.

Instead of trying to cover a lot of heterogeneous phases of their subject, the authors have wisely aimed for thoroughness along four lines: first, training the student to select and use drawing instruments and materials. Just as Stephan's treatise on the same theme reflects the practice at the Case School, so this chapter shows the methods taught at Sibley College (Cornell). The illustrations are clear, the terminology of various parts of the different instruments being seen at a glance, and even the proper use of calipers and steel rules is included.

Second, there is a most explicit chapter on making sloping letters and numerals for use on mechanical drawings. The strokes required for the different letters and the spacings as affected by various combinations of letters are all set forth so clearly that a careful reader can have no further excuse for poor lettering.

Third, a section on "Mechanical Drawing and Drafting-Room Practice," which includes many practical hints not commonly found in college textbooks. The precision with which the authors follow the successive details of each step in drawing is remarkable and shows their thorough grasp of the subject.

Last, but not least, come chapters on "Free-Hand Working Sketches" and on "Isometric Drawing and Sketching." In the former, the authors have missed an opportunity by not advocating the inclusion of a small perspective sketch of the object in one corner of a sheet giving the usual plan and two elevations—a practice which often saves puzzling for those to whom the drawing goes. Also, they give a curious instance of inverted perspective in a view of a headstock (Fig. 98) which must be turned upside down to show the true perspective.

However, these are minor items, far overbalanced by the many good points of the book. By having most of the illustrations relate to parts of a wood-turning lathe, the authors have given the volume a continuity rarely found in such a work, and by including plain hints regarding points likely to puzzle or mislead the beginner (as when they explain and tabulate the markings of the standard triangular scales) they are rendering a fine service to the draftsman and engineer of the morrow. Both the 151 cuts and the index are admirable, while a judicious use of several styles of type makes the emphasis clear at each point, and permits of a more rapid use of the book as a work of reference.

ALBERT SCHEIBLE.

"Primer of Scientific Management." By Frank B. Gilbreth. New York: D. Van Nostrand Company. Cloth, 103 pages (5 x 7½ inches). Supplied by the Electrical Review Publishing Company for $1.00.

The title is unusually descriptive. The book consists of one hundred pages of answers to specific questions received in letters to the publishers of a popular magazine, which contained a serial article on "Scientific Management" by Frederick W. Taylor. The questions have been answered correctly, with sufficient accuracy and, for the most part, so clearly as to be intelligible to a man with only an elementary education. In many cases the answers consist of quotations from various writers on this subject. The reading of this book would be of almost no benefit to a thoughtful man who has already read two or three works on this subject. The essential features of its make-up adapt it particularly for use as a mental aperient by the utter "Philistine" in matters of economic management. Hence this little book might be of material assistance to the consulting management engineer, if distributed together with his own circulars among the more lethargic of his prospective clients at the outset of his educational campaign. Likewise it might facilitate his progress after taking charge of the plant, if the enlightened executive were to distribute copies to the various foremen before the appearance of the engineer.

STAFFORD MONTGOMERY.

"Applied Methods of Scientific Management." By Frederic A. Parkhurst. New York: John Wiley & Sons. Cloth, 325 pages (5¾ x 9 inches), illustrated. Supplied by the Electrical Review Publishing Company for $2.00.

In general this book is a description of the organization developed by the author in a factory, initially in excellent condition, together with examples of some of the results achieved. It is not a treatise on accounting, economics, sociology or psychology. Among previous publications, it somewhat resembles Arnold's "Factory Management," which appeared about ten years ago; but it is at the same time more comprehensive and more exhaustive, and is without the catalog characteristics of the earlier book. The text proper (198 pages) is apportioned roughly as follows: (1) The functions of each unit of the organization (88 pages). (2) Cost-keeping (26 pages). (3) Standardizing the shop (28 pages). (4) Time study (24 pages). (5) Wage systems (29 pages). (6) Psychology (3 pages). The appendix (122 pages and numerous plates) is practically an abridged transcript of the standard works instruction book used by the officers and clerks of the company in question.

It is not a "Pocket-book of Factory Management" nor a complete elementary textbook for academic students. However, it is well adapted to form a part of the required reading of students taking courses in management in schools of engineering and applied economics. Its perusal should arouse a hopeful impulse "to do something" in the spirit of the factory executive and in that of his subordinate who may have an "onward and upward" tendency.

STAFFORD MONTGOMERY.

New Electrical and Mechanical Appliances

A New Beehive Reflector.

To complete the so-called Beehive trio, a series of widely distributing reflectors, the National X-Ray Reflector Company, of Chicago, Ill., has produced the new type illustrated below. The original Beehive reflector, which has been on the market for a couple of years, was designed expressly for the illumination or the Patten Gymnasium of Northwestern University. The manufacturers have since found an extensive application for this reflector in large high rooms, in factories, shops, armories, gymnasiums, press rooms, etc. This large reflector was designed for 100, 150 and 250-watt lamps.

The medium size gives the best results when used with 60 and 100-watt lamps. This reflector is made of glass in one piece and it is comparatively small, being only 7.5 inches high and 7.25 inches in diameter.

The third member of the Beehive trio is a small reflector for 25 and 40-watt lamps. The peculiar designs of the Beehive make them very effective in shielding the tungsten lamps from view. The smallest reflector may be used whenever a wide spread of light is desired from ceilings of average height.

Small Beehive Reflector.

Motor-Driven Fire Pump in a New York Theater.

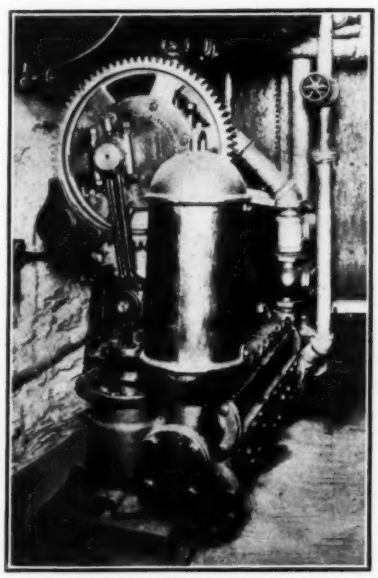
The officials of large cities entrusted with the safety of the citizens have long realized the necessity for adequate auxiliary fire protective apparatus in theaters and halls where large crowds of people gather. The Fire Department of the City of New York, in recognition of this fact, requires the installation of a fire pump in each theater for use in connection with the regular city service in case of a fire.

A good example of the execution of this requirement is shown in the installation illustrated herewith, which is that of the Maxine Elliott Theater, located on Thirty-ninth Street, New York. The equipment consists of a Deming triplex regulation 8 by 8-inch fire pump driven by a 20-horsepower, 220-volt Westinghouse direct-current motor.

The pump has a speed of 50 revolutions per minute obtained through a double-reduction gearing from the 1,300 revolutions per minute of the motor and will deliver at this speed one 1.25-inch stream of water, which is in accordance with the requirements of the fire department. The capacity of the pump is 250 gallons per minute, at a pressure of 100 pounds per square inch. The plungers are solid bronze and the stuffing boxes are brass lined; rusting, therefore, cannot take place and the pump is always ready for immediate operation.

The motor is controlled by means of an automatic starter which is connected through a pressure regulator to the hose reels so that when the hose is removed the pump will start automatically. By this arrangement the additional pressure is instantly available when it is needed and the necessity of having the operator go down into the cellar where the pump is located is obviated.

The pump is also connected to the overhead storage tank on the roof of the theater, which supplies water to the building. Since the installation of the pumping outfit, however, a regulation has been made by the Fire Department which forbids a connection of this kind on the grounds that a fire pump should be used for fire purposes only.



Motor-Driven Fire Pump.

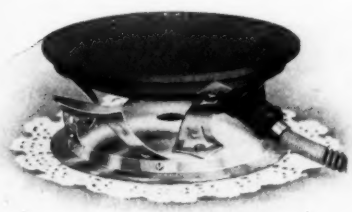
The Vulcan Electric Hot Plate.

The Vulcan electric hot plate is an attractive and very handy electric stove that can be used for a great variety of purposes. It heats up quickly and furnishes a great amount of heat at very small cost. It is so highly finished that it can be used on the dining-room table. The design is graceful and artistic, appealing to people of discriminating taste.

Because of its safety, convenience and efficiency it is also well adapted for use in the nursery or sick room.

It is not only handsome enough for the dining room, but also sturdy and strong enough for the kitchen.

The top of the Vulcan hot plate is 7 inches in diameter, is made of cast iron with handsome gun-metal finish, the legs and base being highly nickeled. The handles and base are always cool. The plate heats on the top only and can be used on a highly polished table without injuring its finish in any way. The cost of operation is about four cents per hour. The outfit comes complete with long cord and detachable plug, and sells at a low price. It is made by the Vulcan Electric Heating Company, Buffalo, N. Y.

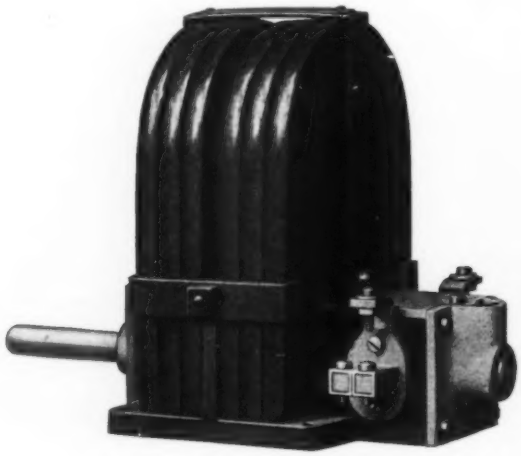


Vulcan Hot Plate.

Electric Speed Indicator.

The desirability of knowing the speed of vehicles, machinery, or shafting at any time is something that is now so generally required in every branch of industrial work that a variety of instruments for this purpose have been brought out from time to time. However, the use of a majority of these indicators is limited to a particular class of apparatus and hence not practicable for use on different applications. For such a universal application the electric indicator, such as the one illustrated herewith, is especially adapted.

This electric speed indicator consists of a magneto-generator and a direct-current measuring instrument. The magneto is attached to a pulley or shaft of the apparatus the speed of which is to be measured and since the voltage of the magneto-generator is proportional to its speed, the meter, which is properly calibrated, indicates the speed directly at any time. When operating at 1,000 revolutions per minute, the magneto generates 25 volts, so that the meter may be calibrated for any unit, as revolutions per minute, cycles per second, percentage fast or slow, or feet per minute.



Magneto for Speed Indicator.

On account of the ease with which these indicators may be adapted to the many types of machinery, they find a wide field of application. The meter may be mounted some little distance from the indicator so that it is possible to place a number of the meters in one place, making it possible for those in charge to note the efficiency of the work in various departments at any time. In connection with newspaper presses, the application is to note the number of copies being printed at any time.

A comparatively new use of speed indicator is for determining the speed of trains or electric cars. The indicator may be attached to the axle and, if the meter is adjusted to prevent jar, this will give excellent results.

The ability to have a complete record of the operation of the machine is made possible by the use of a graphic meter in connection with the magneto. This use will prove especially beneficial where a test of efficiency of a piece of apparatus is desired. For railway trains, such a meter is a good indicator as to whether or not instructions have been carried out regarding the speed along the line. The large number of railroad wrecks that have occurred within recent years due to failure to comply with speed orders has brought the need of such a device more prominently to the notice of railroad officials.

The indicator is small and can be placed anywhere near the machine, the overall dimensions being only 6 by 10 by 10 inches and a variety of meters may be used with it. The magneto-generator which is manufactured by the Holtzer-Cabot Electric Company is especially designed for use with meters manufactured by the Westinghouse Electric & Manufacturing Company.

Touring With an Electric Vehicle.

The statement so often made, that the electric automobile is not a competitor in the touring field—that its boundaries of operation are distinctly defined and limited—can no longer be maintained. The territory hitherto sacred to the gas car has not only been invaded, but most creditably covered, by the electric chosen as the pathfinder for the 1912 Glidden tour, which met and overcame a rather greater number of obstacles than are usual on these trips, and returned victorious from the 1,700-mile test.

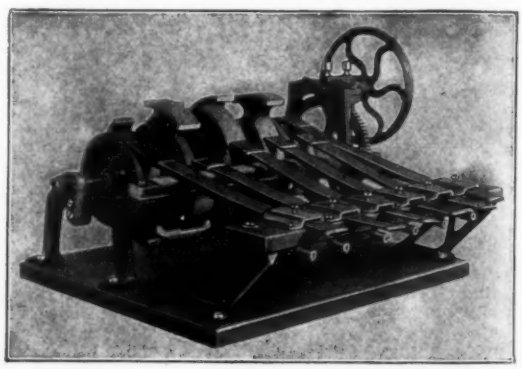
The car used was a four-passenger Flanders coupé equipped with a Willard battery; and it was, of course, due to the performance of this battery that electrical touring, with all it implies of comfort, luxury, cleanliness and safety, has crystallized into a proven fact.

Over roads of every description, through heavy rains, and, at times, pulling through mud that would have severely tried the most powerful gas car, the sturdy electric forged steadily ahead, and succeeded in accomplishing its task with perfect satisfaction, and on previously arranged schedule time, arriving with both car and battery in good condition.

It would be difficult to overestimate the importance of this successful effort in the automobile world. Not only does it open up a vista whose boundaries can only be conjectured, but it necessitates a radical change—a revolutionary adjustment—in the public attitude toward the possibilities of the electric.

A Flasher That Can Be Used For Any Purpose.

The Reynolds-Dull Flasher Company of Chicago is manufacturing a flasher known as the heavy-brush type, which can be used for various effects, such as flashing signs on and off as a whole, alternating two sides, spelling out by letters or words, or for high-speed work, such as electric displays of fireworks, fountains, flames, revolving wheels, etc. There is said to be hardly a limit to the effects produced from this machine by simply changing the cams.



Reynolds-Dull Flasher.

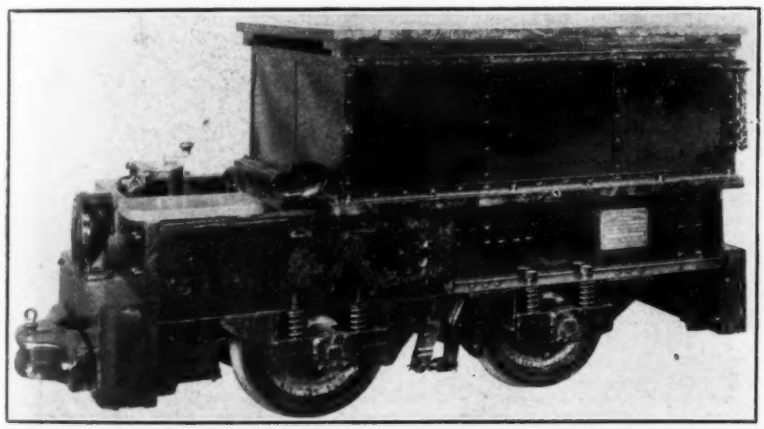
As will be seen from the illustration, the flasher is throughout a substantially constructed machine with heavy iron or brass cams (as the customer may desire), pure copper brushes, machine-cut gears and steel worm. The cams used are solid, thereby having a greater carrying capacity and wearing surface than any other flasher on the market. The machine has a capacity of 20 amperes per switch.

The company states that the large sales of this particular type indicate that it has been highly regarded by the trade, undoubtedly due to the fact that it is a guaranteed machine selling at a low price.

Storage-Battery Locomotives for Tunnel Excavation.

Ten storage-battery electric haulage locomotives are being placed in commission by the Holbrook, Cabot & Rollins Corporation, New York, which is executing a contract for constructing one of the sections of the York City Tunnel now being built for conveying the Catskill water supply into the city. These locomotives are used for transporting excavated material on cars to the mouths of the shafts which have been sunk approximately a mile apart for expeditious operation. The material is then hoisted to the surface. The locomotives are of a type similar to the twelve locomotives Smith, Hauser, Locher & Company are now employing for putting through another section of the same tunnel, but they are of somewhat different design.

The application of these locomotives is novel in that they represent the pioneer storage-battery types built for hauling trailing loads in tunnel work. The new locomotives have a four-ton rating and are coupled up to four trailers to form the usual train. Industrial or tunnel locomotives impelled by storage batteries are designed specifically for short-distance hauls at moderate speeds, where it is not possible or feasible to install an overhead trolley system. The latter system is employed to better advantage in most cases; but where local conditions demand the storage-battery type, it has proved in service an excellent substitute.



Storage-Battery Locomotive.

In the case of the New York tunnel, trolley locomotives were prohibitive because the tunnel headings would not permit their entrance. The operation of storage-battery haulage locomotives, manufactured by the General Electric Company, has proved efficient and economical for this work and has permitted laying the tracks without the filling necessitated when hauling by mules in tunnel excavation.

The new haulage locomotives are built to conform to the following specifications:

Diameter of wheels	20 inches
Wheel base	34 inches
Total weight	8,000 pounds
Length over all	7 feet. 10 inches
Height over batteries	49.75 inches
Track gauge	24 inches
Speed at maximum tractive effort	3.5 miles per hour

Each battery has 44 cells and five-hour discharge capacity, although the battery equipment may be arranged to suit individual requirements. To facilitate removal the battery trays are provided with rollers. Each locomotive is equipped with an ampere-hour meter, headlight and gong.

Latest modern practice has been incorporated in the mechanical design. The frame consists of two steel channel sides and steel plate ends carefully fitted at the joints and held rigidly together with bolts and steel angles. A seat for the operator is provided in front and couplers suitable to the type of cars employed are attached at both ends. The cast-steel journal boxes are of a special design and are fitted with roller bearings, which assure efficient mechanical transmission of power and consequent economy in battery-current consumption. The weight of the car is supported from the journal boxes by pairs of coiled springs.

The motors are of the familiar automobile type, designed especially to operate from batteries, and have characteristics that effect the maximum possible economy in the use of battery current. They have high efficiency, large overload capacity and operate with practically sparkless commutation. The high efficiency is obtained by designing the motors with a small air gap and running the iron at low densities. On account of the low densities, the speed and torque characteristics are steeper than in the ordinary series motor, thereby tending to limit the overload which can be thrown on the batteries. The armature shaft rotates in ball bearings, and consequently the friction losses are very slight and the bearing wear is practically negligible. The motors are very compactly designed, yet readily accessible for inspection and repair. They are dustproof and moistureproof, and are mounted in cast-steel suspension cradles, one side being supported on the axle bearing and the other side spring-suspended from the locomotive frame, in accordance with standard locomotive practice.

The motors drive the axles through double-reduction gearing, an intermediate shaft, supported in the bearing housing cast integral with the suspension cradle, carrying the intermediate gearing. As slow service is ordinarily required of a storage-battery locomotive, the use of double-reduction gearing permits such speeds without rheostatic losses; and, due to the large gear reduction from armature shaft to wheel tread, very high tractive efforts are obtained at comparatively small current inputs to the motors.

The storage batteries are specially designed for the service, are of rugged construction and have specially made plates with high ampere-hour efficiency. The cells are grouped in four or more trays and are mounted on top the locomotive frame in a sheet-iron case with wooden base and cover.

Motors for Storage-Battery Train.

Reference has briefly been made in these columns to the public test of a three-car storage-battery on September 25 last. This marked a new era in electrical transportation, it being the first run of a complete railroad train by storage-battery power under the multiple-unit control of a single operator. The three-car train itself was constructed for the Unidos Habana, of Cuba. The trial trip, on which many prominent railroad men were present, was made from the Pennsylvania station in New York City to Long Beach, L. I., and carried in the three cars about 140 passengers, making the trip of 25.6 miles each way in 56 and 52 minutes, respectively.

The cars were made by the Federal Storage Battery Car Company, Silver Lake, N. J.; the battery equipment consisting of 200 Edison type A-6 cells was furnished by the Edison Storage Battery Company; the multiple-unit control apparatus was manufactured by the Cutler-Hammer Manufacturing Company; the traction motors were made by the Diehl Manufacturing Company, Elizabethport, N. J.

The type of car used in the trial run has a length of 38 feet, 5 inches. It is

equipped with vestibules and provided with four double seats and four end seats, accommodating a total of 40 passengers seated. The trucks of the car are of the four-wheel type, eight wheels to a car, with two 10-horsepower motors mounted on each truck. The axles are fixed and the wheels rotate on roller bearings around them, being driven by spur gears engaged in an extra hub bolted to the skeleton spokes of the light steel wheels.

On the day previous to the public trial run the same three cars were uncoupled and operated separately with spaces of about a foot apart. It is reported that all the motors retained their uniformity of speed, the cars maintaining their relative space with scarcely any variation.

A few facts and figures regarding the Diehl type K special storage-battery motors given herewith serve to illustrate the extreme care in design and the efficiency which the motor must maintain to meet the standard of the service.

For cars built by the Federal Storage Battery Car Company there are used four sizes of Diehl motors, the sizes depending upon car dimensions and capacity. These motors are all series wound and are rated as follows:

Type K-6, 5 horsepower, efficiency 85.5 per cent, normal load, 40 amperes at 100 volts or 20 amperes at 200 volts, speed 800 revolutions per minute.

Type K-6, 10 horsepower, efficiency 86 per cent, normal load 75 amperes at 100 volts, 37.5 amperes at 200 volts, speed 800 revolutions per minute.

Type K-8, 15 horsepower, efficiency 87.1 per cent, normal load 112 amperes at 100 volts, 56 amperes at 200 volts, speed 800 revolutions per minute.

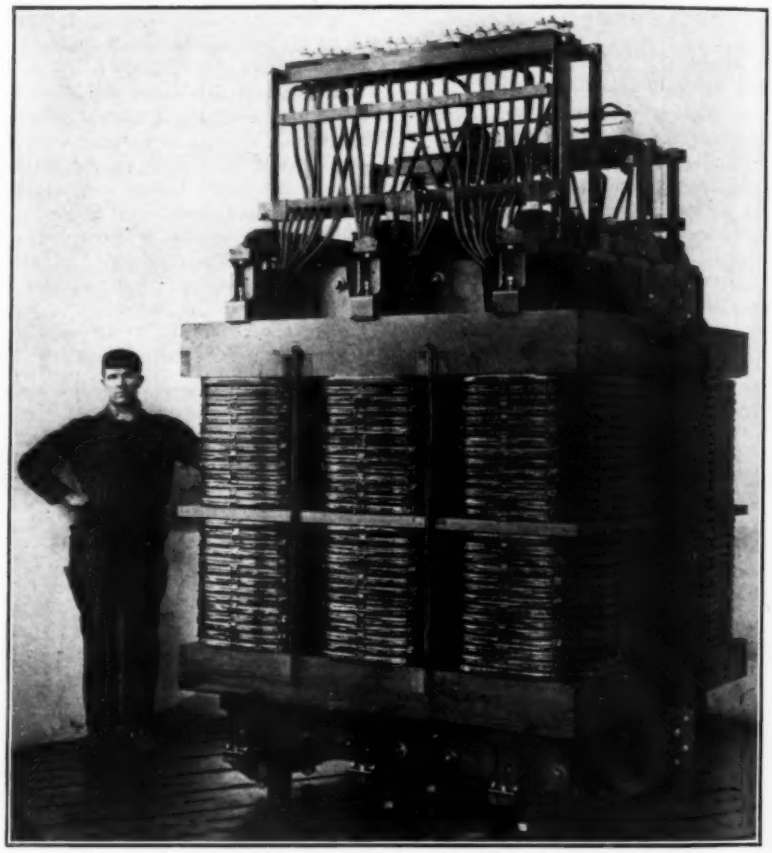
Type K-10, 20 horsepower, efficiency 88.7 per cent, normal load 150 amperes at 100 volts, 75 amperes at 200 volts, speed 950 revolutions per minute.

At 200 per cent overload the motors will develop approximately 62.5 per cent of their normal speed and at 100 per cent overload 70 per cent normal speed. Their weight varies from 350 pounds in the smaller sizes to 1,190 pounds in the larger. They develop a temperature rise under normal load for one hour on inclosed floor test of 45 degrees centigrade. The standard railroad guarantee gives a latitude of as high as 75 degrees.

During the trial run of the three-car train, the start was particularly noticeable for the very easiness with which the train glided out of the station, there being a total absence of a starting jerk. Acceleration of speed was gradual at first but increased very rapidly. A high speed was maintained for a considerable period, at times being as high as 35 miles an hour. The road to Long Beach is particularly adapted to such a test, being comparatively level with the exception of one stretch which grades heavily rising from the Pennsylvania tunnels to the level of Long Island City. The motors took this grade at about 100 per cent overload.

Large Three-Phase Transformers for Great Northern.

The Crocker-Wheeler Company, Ampere, N. J., has recently installed two 25-cycle, 4,500-kilovolt-ampere, three-phase, core-type, butt-joint, water-cooled transformers at the Superior transformer station of the Great Northern Power Company. The high-tension side is arranged for 66,000 or 33,000 volts and the low-tension side for 13,200 or 6,600.



Large Crocker-Wheeler Transformer.

These transformers were put to a sudden and severe test just a few hours after they were ready to be put into regular service. On one of the towers of the transmission line running to the Duluth transformer station, which is tied in with the Superior station, six insulators were shot to pieces by rifle bullets, evidently with malicious intent, thereby putting out of service the transformers in this station. As this occurred just at the beginning of the peak load period the two Crocker-Wheeler transformers at Superior had to carry upwards of 6,000 kilowatts apiece until the damaged lines had been repaired and normal service restored.

Grinnell "Big-Four" Electric Washer and Wringer.

To take care of the growing demand for a bench-type washer embodying the important features of its well known Grinnell line, the Grinnell Washing Machine Company, of Grinnell, Ia., has recently put on the market its new "Big-Four" washer and wringer. The name is significant of the construction, as the tub used on this machine is considerably larger than any other washer on the market and with its revolving wringer the machine is capable of wringing into or out of four tubs or other receptacles.

The bench is new in washing-machine construction. It is made of heavy high-carbon angle steel which in its normal position holds the washing tub and an additional tub but has the unique feature of a folding or collapsible extension which will hold two tubs or baskets, making the capacity of the machine greater than any other washer of its kind. It is almost a complete laundry in itself. It is strong, quiet running and a perfect washer and wringer combined. For large families, summer resorts, country hotels, and boarding houses, it has proven itself as a rapid, economical and satisfactory laundry equipment.

The revolving wringer, which is rigidly supported on a steel and iron post, rotates to any position and locks there. It will wring the heaviest quilts, blankets or overalls quickly and thoroughly. This wringer is equipped with eleven-inch rolls and compression springs of about twice the length ever before used on wringers. These features permit the wringing of heavier articles and make the life of the wringer a great deal longer than with springs of the old style.

The entire machine is neat and attractive; with the extension bench folded it occupies a space of only about two by four feet and will pass through any ordinary door with no trouble. It is adaptable to any power, and comes equipped with a high grade electric motor, if desired. The simplicity of the construction is undoubtedly the most important feature of this new machine, since it is operated with a direct-shaft drive through the Grinnell internal planetary gear running in long adjustable self-oiling boxes.

Grinnell "Big-Four" Washer and Wringer.

The large tub is made of well-seasoned cedar and opens without stopping the power. The cover is attached with heavy iron hinges. The tub is hinged to the frame for draining and has a solid dolly with telescoping shaft.

All moving parts are completely inclosed and there is a total absence of belts, levers, flywheels, governors, springs and the multiplicity of moving parts that are features of many washers. This machine is quiet in operation, requires very little power and has fewer parts than any other to cause trouble or get out of order.

The company reports that it has never offered a washer to the trade that has been so popular.

New Receptacle for Display Work.

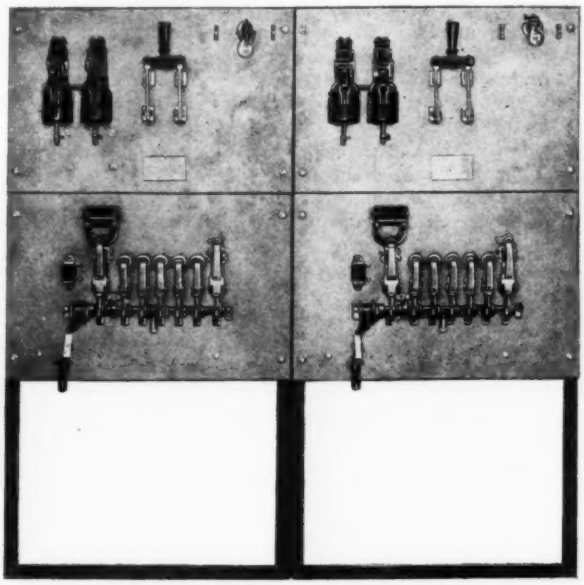
A new type of outdoor receptacle has been placed on the market by Pass & Seymour, Incorporated, Solvay, N. Y. As shown in the illustration herewith, this receptacle holds the wires one inch from the surface wired over and has been found well adapted for use in many cases of outdoor decorative lighting as well as in some forms of sign construction. The terminals have been arranged to permit the use of a sealing compound that may be poured over the contacts after the connections are made. The lugs for supporting the receptacle are arranged so that a stove bolt with square head may be used if desired.

New Pass & Seymour Receptacle.

Fire-Pump Starters Built to Associated Factory Mutual Specifications.

The requirements regarding the design and operation of fire-pump starters vary in different parts of the country. The rules of the Associated Factory Mutual Fire Insurance Companies are also somewhat different from those of the National Board of Fire Underwriters. The principal feature required by both is reliability. The Chicago Board of Fire Underwriters requires combination automatic and manual starters while the Factory Mutuals at present require manually operated starters only.

The accompanying illustration shows a duplex panel for manually starting two 125-horsepower 220-volt fire-pump motors. It is built by the Cutler-Hammer Manufacturing Company, of Milwaukee, Wis. When installed the entire panel is inclosed in a splash-proof ventilated case with doors and a removable back. The bottom of the panel must be at least two feet above the floor; no fuses are placed in the operating circuits although automatic release and overload release are provided. No fiber parts are used; there are no iron-to-iron bearings and all iron or steel parts are copper-plated or enameled. As particularly required by the Chicago department of the Factory Mutuals the operation is of the single-lever type with "butt" accelerating contacts, seven on these panels. A pilot switch is placed above where the meter will be located which is used to indicate the voltage of the line supply. The resistance is mounted on the backs of the panels and is inclosed. Connections, terminals, etc., are of more liberal capacity than found on control panels used for other than fire-protective service.



Duplex Cutler-Hammer Fire-Pump Starting Panel.

Arizona Copper.

Arizona has a recorded production of 3,494,333,111 pounds of copper, or 21.38 per cent of the total output of the United States since mining began. In 1911 Arizona produced 303,202,532 pounds of blister copper, as compared with 297,250,538 pounds in 1910. This is the largest output in Arizona history.

Locking Device For Disconnecting Switches.

At the present time the general use of electricity is practically an accomplished fact. To realize how dependent the people are upon the electric current it is only necessary to be at the power-house end of the telephone when the power is off and an exasperated public has waited for what it considers a reasonable length of time for its restoration. A shutdown of the machinery may mean not only serious delay in finishing work, but also many men, who are paid high wages, standing around idle. This condition makes it imperative that every device be employed which makes for continuity of service.

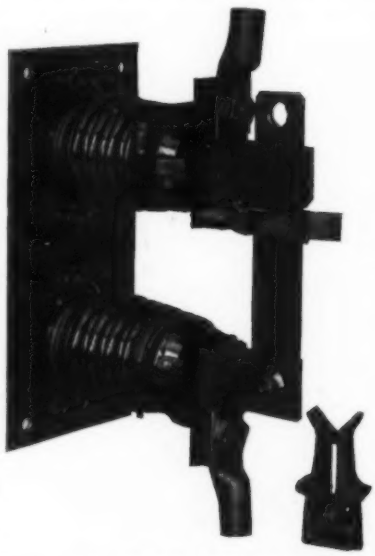
The illustrations herewith show a locking device that effectually prevents the blade of a disconnecting switch from opening except under the direction of the operator. Instances are on record where the blades of disconnecting switches not protected by such a device have been thrown open or partly open by magnetic repulsion and destroyed when a short-circuit has occurred on the lines, resulting not only in the loss of the switches but also putting the circuits on which the switches were installed out of commission till new switches could be installed, unless there were duplicate circuits.

The safety catch or locking device is a unit in itself and can be applied by anyone to any GE type L, form G-6 switch merely by clamping it to a support placed between the clip lock and the insulator cap. It is of rugged design and is operated with a switch hook. This locking device consists essentially of two brass bell cranks hinged together at the end of the two shorter arms and held closed by compression springs. The projections or jaws in the outer ends of the two longer arms close in front of the blade, thus preventing the latter from coming out of the clips. Each bell crank is provided with a dog which moves in a slot in the bell's elbow, the dog being hinged at this point. Two compression springs, one pressing outwardly from the switch base against the elbow of each crank and also against the dog, keeps the bell cranks closed and the dogs pressed against the back of the switch blades.

To open the switch the outer ends of the bell cranks are pressed back away from the blade allowing the dogs to come forward so as to rest upon the sides of the blade, in which position they hold the jaws in front of the blades apart allowing the switch to be opened. Withdrawing the blade of the switch from between the dogs causes the jaws to automatically close against the sides of the blade and to snap shut as soon as the blade is completely withdrawn.

As the outer edges of the jaws are beveled the switch blade can be readily pressed back in the clips into the closed position, since the jaws close automatically in front of the blade, locking the latter in the closed position. The operator can't forget to lock the switch closed, as it automatically locks itself.

This device is made in sizes to fit 300, 600, 800 and 1,200 ampere-switches as standard and can be furnished for a switch of any capacity. It has been on the market for a comparatively short time, yet it is being used by practically all important electrical operating companies in the United States. The device is manufactured by General Electric Company, Schenectady, N. Y.



Disconnecting Switch with Locking Device; Separate View of Latter in Lower Right Corner.

Method of Opening Locking Device and Switch.

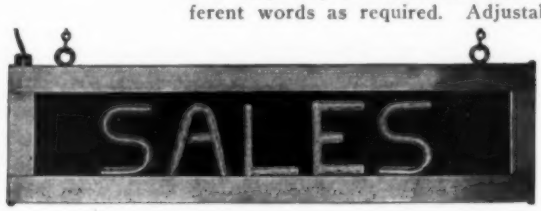
Brazilian Power Project.

A company has been organized in Rio de Janeiro, Brazil, for the purpose of utilizing the Paulo Alfonso Falls of the San Francisco River to generate electric power. At first 200,000 horsepower will be generated, which quantity is to be increased at a later date to 300,000 horsepower.

Miniature-Lamp Letter Electric Signs.

In the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of October 28, 1911, there were described and illustrated the miniature electric-sign letters, consisting of evacuated glass tubes in the shape of letters and containing a number of small filaments. Each of these letters constitutes a separate unit and they can be combined to form any desired wording for a sign.

This system of interchangeable letter signs has been taken over by the Federal Sign System (Electric), Home Insurance Building, Chicago, Ill., and a specimen of the signs being placed upon the market by this company is shown in the accompanying illustration. Each letter constitutes a separate 110-volt incandescent lamp. A variety of metal frames and fixtures adapts them for every purpose and they can be easily attached to any lighting circuit. They are adapted to all lines of business and the wording of the sign can be changed at will and as often as may be desired. The miniature letters are 3.5 inches in height above the porcelain base upon which the lettering is mounted, and are so constructed that they may be assembled into different words as required. Adjustable metal fixtures are supplied. They are simple in construction and easily set up. A metal trough or fixture holds the porcelain of the letter securely in place and can be adjusted to any angle. The frames are furnished complete with all necessary connections, including 10 feet of insulated cord and a swivel attachment plug.



Federal Miniature-Lamp Letter Sign.

Current Electrical News

LIGHTING AND POWER.

(Special Correspondence.)

MADISON, MINN.—The Council has voted to install a cluster-lamp system on Sixth Avenue. C.

GREENFIELD, IOWA.—This city has voted $9,000 bonds for modernizing the electric light plant. C.

ETNA, PA.—Etna Electric Light Company has been incorporated with a capital stock of $5,000.

MILLVALE, PA.—Millvale Electric Light Company has been incorporated with a capital stock of $5,000.

WELLSVILLE, O.—It is reported that this place is to shortly install a municipal electric lighting plant.

MACOMB, ILL.—The Central Illinois Service Company has promised this city a better lighting system.

LAKE CITY, MINN.—Professor J. B. Hill of Iowa City, is preparing plans for a proposed municipal electric light plant. C.

DALHOUSIE, N. C.—This city has voted to install a municipal electric lighting plant to cost approximately $20,000. W.

MANDAN, N. D.—The City Commission has under consideration the establishment of a municipally owned lighting plant.

PEQUOT, MINN.—The Pine River Electric Light & Power Company of Pine River may extend a transmission line to this city. C.

ROANOKE, VA. — The Roanoke Railway & Electric Company will install a "Great White Way" system in several blocks of this city.

ADEL, IOWA.—The County Board has granted the Adel Mill Company permission to string transmission lines along certain county roads. C.

SNYDER, TEX.—E. W. Clark has purchased the property of the Snyder Ice, Light & Power Company and will improve the lighting and power plant. D.

BOWDLE, S. D.—Plans are completed for an electric light and water works system to cost $22,500. The electric light plant will be constructed immediately. C.

BASSETT, NEB.—M. E. Buckendorf, city clerk, will receive new bids for the electric light and water works, the cost of which is estimated at $16,000. C.

BAKERSFIELD, CAL.—The San Joaquin Light & Power Company plans to expend approximately $25,000 during the winter in the enlarging of its Crane Valley reservoir.

MARBLE ROCK, IOWA.—Bonds have been voted for the constructing of a dam across the Shell Rock River and installing a municipal electric light plant. C.

CORYDON, KY.—A bond issue of $8,000 to finance the erection of an electric light and power plant was recently authorized by the citizens of this place. G.

ELWOOD CITY, PA.—The Pennsylvania Power Company, of this city, is securing the right of way for a power line from West Pittsburgh to New Castle.

RIVER ROUGE, MICH.—It has been decided to bond the village for $15,000 to improve the lighting plant, so that light and power may be given both day and night.

LOS ANGELES, CAL.—Plans to light 16.25 miles of road in San Fernando valley with ornamental cluster lights are under consideration, $75,000 having been appropriated for that purpose.

LOGANSPORT, IND.—The city authorities have been authorized to issue and sell bonds to establish a new and improved filtration plant and some new corporation machinery. S.

LARGO, FLA.—At a special election held a short time ago it was decided to issue bonds to the amount of $10,000 for the installation of an electric light and waterworks plant.

ST. PAUL, MINN.—The South St. Paul Gas & Electric Company has filed articles of incorporation with a capital stock of $500,000 by W. D. Mitchell, John P. Crowley and Henry Gille.

BURLINGTON, IOWA.—The City of West Burlington has voted to grant a franchise to the Burlington Power Company. Transmission lines will be constructed from Fort Madison to West Burlington at once. C.

HARDIN, KY.—This city will buy a five-kilowatt electric dynamo, wires and other street-lighting equipment in the near future. The Mayor may be addressed for specifications of the work. G.

FRANKFORT, KY.—The Kentucky Public Service Company is considering the instalation of ornamental lighting standards and other equipment along Main and St. Clair Streets in the Bluegrass capital. G.

VICTORIA, B. C.—The British Columbia Electric Railway Company has decided to expend $1,500,000 in increasing its power plant at Jordan River. The present capacity of 12,000 horsepower will be doubled.

CHISHOLM, MINN.—The Chisholm Electric Company has been incorporated with capital stock of $100,000 to operate an electric light plant here. The incorporators are Will A. Koon, Clark Hempstead and John H. Ray, Jr. Z.

PORTLAND, ORE.—Articles of incorporation have been filed for the Saint Helena Light & Power Company with a capital stock of $50,000, by Charles R. McCormick, E. H. Meyers and E. F. McCormick.

CHIPPEWA FALLS, WIS.—The Chippewa Valley Electric Railway & Power Company has bought the plant of the Spring Valley Electric Light and Power Company, and will make a number of improvements. C.

CONNERSVILLE, IND. — The Heat, Light & Power Company is planning to double the capacity of its plant by contracting for the erection of a large addition and for the installation of a new turbine. S.

JERSEY CITY, N. J.—The Electric Power Company has been incorporated with a capital stock of $100,000 to operate electric-lighting plants. Edward N. Abbey, Charles A. Bruce and Thomas Roberts, Jr., are given as the incorporators. A.

SAN DIEGO, CAL.—The Council has adopted an ordinance ordering that all wires, cables and other contrivances used for transmission of electricity for light, heat, power or telephone be placed under ground in conduits 18 inches below the surface.

TAYLOR, TEX.—The Citizens' Light & Power Company has been granted a franchise to build a transmission line to San Gabriel, a distance of five miles, for the purpose of furnishing light, heat and power to the residents of that place.

PEMBROKE, KY.—Separate municipal franchises for the operation of an electric light and power plant and a waterworks system have been purchased from the Board of Trustees by G. S. Ragsdale, of the Pembroke Light, Power & Water Company. G.

CHARLESTON, W. VA.—The Virginia Power Company of Boston will erect three power plants on the New River at Cabin Creek Junction at an estimated cost of $2,000,000. It is planned to supply the New River and Kanawha coal fields with power.

GLASGOW, KY.—Dickinson Brothers, who own and operate an electric light and power plant here, have contracted to erect and have in operation a similar plant in Horse Cave, Ky., by January 1. Arrangements have been completed with the Town Board. G.

CHATTANOOGA, TENN.—A. W. Burke, president of the Retail Merchants' Association, is considering bids for furnishing labor and materials for the modern street lighting system to be installed throughout an extensive portion of Chattanooga's retail-business district.

WYOMING, ILL.—Stark County Power Company has been incorporated with a capital stock of $20,000 for the purpose of manufacturing and selling electric current and steam for heating. Edwin B. Hillman, Adele Hillman and Edgar P. Reeder are the incorporators.

SHREVEPORT, LA.—The Southwestern Gas & Electric Company of Delaware has purchased the Shreveport Gas & Electric Light Power Company and the Caddo Gas & Oil Company, and it is stated will issue $3,000,000 to retire outstanding indebtedness and make extensions.

ELKTON, MD.—The Susquehanna Power Company has purchased the Rainey tract for its proposed hydro-electric plant at Conowingo. This tract extends for a distance of nearly two miles and nearly completes the purchase of the riparian holdings necessary for the erection of the plant.

UNION CITY, IND.—The officials of the Union Heat, Light & Power Company have notified the Secretary of State that the company has increased its capital stock from $50,000 to $200,000 with a view to making extensions and improvements in the plant. Some new light and power machinery will be installed. S.

FREEPORT, L. I.—The village Board of Trustees has engaged Francis Broadnax, a Manhattan engineer, to draw up plans and specifications for the extension of the water and light system in the local power house and to advertise for bids. If these are above the $20,000 appropriation, a special election will be called.

BOSTON, MASS.—The Light, Heat & Power Corporation, of this city, has acquired the franchise recently granted by New Smyrna for the electric power plant at that place and will commence construction work at once. The same company has purchased the local ice plant and will greatly enlarge the capacity.

MONROVIA, CAL.—The City Engineer has been instructed to prepare a map of the conduits and lights to be erected within the city limits in connection with the "White Way" that is to run from the San Gabriel Valley to the Coast. Estimates of the cost have been made and it is said that actual construction work will be begun soon.

POTSDAM, N. Y.—The Northern Power Company, of this city, has secured rights of way from Antwerp to Rossie for the purpose of transmitting electric power along the highways, and it is expected that construction work will be started in the spring. It is the desire of the company to have the line in operation by the fall of next year.

TROY, N. Y.—A conference between the Committee on Illumination and the Troy Gas Company has resulted in a decision to install a brilliant and artistic electric lighting system. The gas company has announced that the cost of installation will be met by the corporation. It is proposed to install some 274 street lamps and the estimated cost of the installation is about $40,000.

WATSEKA, ILL.—The Central Illinois Utilities Company has issued a prospectus in which the company states that it will erect a main central power plant costing about $100,000 at the junction of Sugar Creek and the Iroquois River, one mile north of this place. The plant will be of the most modern type and its location is most advantageous on account of the excellent water supply for condensing purposes.

MONTPELIER, VT.—The Montpelier & Barre Light & Power Company has been incorporated in Massachusetts with a capitalization of $2,100,000. Boston men are interested in the concern. It is reported that a merger of the electric light, power and traction companies, centering in Montpelier, Vt., will be effected. These companies are the Vermont Power & Light Company and the Consolidated Lighting Company.

TRENTON, N. J.—The Somerset Light & Power Company has been incorporated under the laws of New Jersey with a capital stock of $5,000 with the object of damming the Delaware River at four points above this city for the purpose of supplying power for plants to furnish power and light. These dams will be constructed near Lambertville, Washington's Crossing, Bryam and Milford. Power houses will be constructed along the river at points near the dams.

EL PASO, TEX.—The Texas Light & Power Company of Dallas has purchased the holdings here of the El Paso Gas & Electric Company, and will extend the lighting system and enlarge the plant. It is announced by J. F. Strickland of Dallas, president of the company, that the purpose of the chattel mortgage recently filed is to allow the issuance of such bonds as may be necessary for the extensions and improvements to be made to the large number of electrical plants which it has recently purchased in different towns in Texas. D.

CHARLOTTE, MICH.—It is stated that the Consumers Power Company, which is a subsidiary of the Commonwealth Power Company, will build a high-tension power line from Charlotte to Eaton Rapids. This line will be built primarily to furnish electric motive power for the woolen mills of Horner Brothers which carry a load of 22 horsepower. Other commercial concerns desiring electric power will be taken care of, but no private contracts will be accepted. That street cars will follow along the line of the high-tension towers in the near future is acknowledged by those in charge of such matters.

ALBANY, N. Y.—The Wisconsin Edison Company has been formed with a capital stock of $10,000,000 for the purpose of taking over the holdings of the North American Company in Wisconsin, and the public utilities which it controls within the state of Wisconsin. The new company will own the capital stock of the Milwaukee Electric Light, Heat & Traction Company, which in turn controls the Milwaukee Electric Railway & Light Company; the Wisconsin Gas and Electric Company the Kenosha Electric Railway Company and the Kenosha Gas & Electric Company, the Watertown Gas-Electric Company and several others.

CAMDEN, N. J.—The Milford Hydro-Electric Company, the Delaware Hydro-Electric Company, and the Bushkill Hydro-Electric Company have been incorporated, each with an authorized capital of $125,000 and with offices at 417 Market Street, Camden. The companies are organized for the purpose of damming the Delaware River at three respective points in Sussex County, N. J., to corresponding points on the Pennsylvania side, and constructing hydroelectric power plants and distributing systems therefor. The incorporators of the first named company are H. B. Gill and W. B. Lind, both of Philadelphia, Pa., and G. H. B. Martin, Camden; of the second named, Frank R. Hunsell, Philadelphia, and John A. MacPeak and G. H. B. Martin, Camden; of the third named, J. T. Shrader and J. Rech Guches, both of Philadelphia, and G. H. B. Martin, Camden. ,A.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

BEAVER DAM, WIS.—The Wisconsin Telephone Company will rebuild the local lines. C.

BLUE EARTH, MINN.—The Blue Earth Valley Telephone Company will entirely rebuild the local lines. C.

PULLMAN, WASH.—A 50-year franchise has been granted the Inland Telephone & Telegraph Company.

ARCOLA, ILL.—The Arcola Telephone Company has been granted a 20-year franchise by the City Council.

BROOKINGS, S. D.—The Council has decided to place the heaviest lines of the telephone system underground.

BROOKSTON, MINN.—The Zenith Telephone Company contemplates installing a farmers' telephone system in Midway. C.

WILTON, WIS.—Wilton Telephone Company has been incorporated with a capital stock of $3,000 by A. O. Leary and others.

SLATER, WASH.—A new company headed by Mr. Stewart, is being organized here to construct a telephone line from this city to Burbank.

LYND, MINN.—Lynd Farmers' Telephone Company has been incorporated with a capital stock of $5,000 by William Banks, F. W. Vanstrom and others.

GLENDALE, KY.—Farmers' Telephone Company has been incorporated with a capital stock of $500 by B. F. Craddock, S. S. Simmons, E. A. Smith and George Chenault.

TOWER CITY, N. D.—Northern Rural Telephone Company has been incorporated with a capital stock of $6,000 by Daniel Miller, W. O. Clark and W. C. Gray, all of this city.

RAY, N. D.—Williams County Mutual Telephone Company has been incorporated with a capital stock of $10,000. The incorporators are H. A. Nelson, Philip K. Everson and Rudolph Hoel, all of this city.

SANBORN, N. Y.—Sanborn Home Telephone Company, Incorporated, has been granted a charter with a capital stock of $7,500. The incorporators are B. L. Hudson, R. E. Casselman and Frank R. Stover, all of this city.

FOSSTON, MINN.—The Garden Valley Telephone Company has arranged to buy the system of the Fosston Telephone Company. The former is installing cables, and other work, and a new switchboard will also be installed. C.

SAN DIEGO, CAL.—The Pacific Telephone & Telegraph Company plans to open an exchange in Ocean Beach, extending to Point Loma tracts. The improvements will require about 7,000 feet of cable and a complete new system of poles.

BELVIDERE, N. J.—The Patrons' Telephone Company plans for the construction of a line between Johnsonsburg and Marksboro, touching other points in Frelinghuysen Township. The company has commenced work on a line from Belvidere to Sarepta. A.

JACKSONVILLE, FLA. — The Home Telephone Company has been chartered here with a capital stock of $1,325,000 for the purpose of building and operating an automatic telephone system. The company is headed by Charles Blum. The length of line to be built is about 1,000 miles.

ELECTRIC RAILWAYS.

(Special Correspondence.)

RIALTO, CAL.—The Crescent Railroad Company has been granted a 50-year franchise in this city.

DUBUQUE, IOWA.—The Union Electric Company proposes a car line on West Locust Street. C.

PACIFIC GROVE, CAL.—Bids will be received up to December 2 for a 50-year franchise for a single or double-track street railroad.

ARCADIA, FLA.—It is rumored that an electric traction line is to be built from Arcadia, *via* Bigler, to a tract of land owned by Henry Johnson and others, of Milwaukee, Wis.

DULUTH, MINN.—It is rumored that the Mesaba Range Traction Company which is now building a trolley line from Hibbing to Gilbert, Minn., may extend its line to Duluth. C.

HELENA, ARK.—E. C. Hornor, who recently purchased the Marianna Light & Power Company, has stated that the proposed electric line between Helena and Marianna will be a reality. It is expected that surveys for the route will be made soon.

GAINESVILLE, TEX.—Extra interest has been added to the Gainesville-Sherman interurban project by the announcement of James L. White, who says that construction work will be started soon. Thirteen miles of the right of way have already been secured of a total distance of 38 miles.

SHARON, PA.—It is reported here that the Farrell Realty Company is going to build a local street railway loop to traverse the town and to afford the East Hill and northern part of the town means of getting to and from the works, post office, railway station and stores.

GREENVILLE, TEX.—J. L. White of Dallas and associates have under consideration the project of constructing an interurban electric railway between Greenville and Anna, a distance of about 20 miles. The route of the proposed line is through a thickly populated agricultural section. D.

SIOUX FALLS, S. D.—H. W. McKnight, of Chicago, who is promoting the electric railway to run from Albert Lea to Sioux Falls, making a total distance of 225 miles, has announced that practically all the right of way has been secured for the road and that grading will begin in the spring.

KALISPELL, MONT. — Flathead Valley Interurban Railroad Company has been incorporated with a capital stock of $50,000 for the purpose of building an interburban railway from Kalispell to Somers and Big Fork. The incorporators are D. R. McGinnes, R. P. Austin, W. H. Griffin, R. J. Benn and Christ Prestbye.

CENTRALIA, WASH.—The Washington Electric Company, recently incorporated under the laws of Oregon, to construct an electric railway from Vancouver, through this city, to Tacoma, has secured an option on the old grade and right of way of the T. O. C. V. Railway, and it is reported will start construction work this month.

CINCINNATI, O.—Work is to be commenced in the near future upon the construction of the traction line of the Cincinnati, Louisville, Lexington & Maysville Traction Company, between Jonesville and Owenton, Ky. The grading of the Owen County right of way has been completed and funds are now in shape for the remainder of the work. G.

SAN FRANCISCO, CAL.—The Public Utilities Committee has recommended to the Board of Supervisors the granting of a revocable permit to the United Railroads for the construction and maintenance of a double-track electric car line from Bay and Polk Streets, along Bay Street to Van Ness Avenue and into the Fort Mason Military Academy.

MOUNT CARMEL, ILL.—It is rumored that Mount Carmel is to have an electric railroad within the next few months by the extension of the Oil Belt Road, which is being operated between Oblong and Martinsville, to this city. W. E. Finley is named as the promoter of this project and it is stated that Indianapolis capital is to finance the construction.

MEDFORD, ORE.—It is reported in this city that the Rogue River Valley Railroad is making preparations to build a street railway system in Medford. It is also reported that John C. Barnum, secretary and general manager of the line between Medford and Jacksonville, has bonded that road for $100,000 with the intention of electrifying the entire system.

SAPULPA, OKLA.—Plans are now on foot, with apparently good prospects of success, for a consolidation of the Sapulpa and Tulsa railway companies and the building of an interurban line between the two cities by the consolidated company. The promoters of the new scheme are endeavoring to float a bond issue in Chicago, with which to put it through. P.

CONNEAUT, O.—The Conneaut, Kingsville & Ashtabula Railroad Company has been incorporated with a capital stock of $25,000 for the purpose of building an interurban between the cities of Conneaut and Ashtabula. The company will also furnish electric light and power. The incorporators are William E. Hawley, Raymond C. Thompson, Junius F. Fox and Charles E. Hawkins.

WASHINGTON, IND.—The Washington Electric Street Railway Company, capitalized at $50,000, has filed articles of incorporation. The declared object of the corporation is to construct, maintain and operate upon and through the streets of Washington and beyond the city limits through Daviess and adjacent counties, an electric street and urban railroad. The directors are Ziba F. Graham, William R. Gardner, Clinto R. Tharp, Charles G. Gardner and Charles C. Colbert. S.

CARROLLTON, GA.—H. G. Lowry, of this city, is said to be backing a proposition to build an interurban line between Atlanta and this city. Options have been secured at Belle Shoals, on the Dog River, where, it is stated, enough electric power can be generated to run the railway and furnish lights for both Atlanta and Carrollton. The new line would divide as nearly as possible the territory between the Southern and the Atlanta and West Point railroads, running through one of the most prosperous and thickly settled parts of the state.

OMAHA, NEB.—With the completion of the various power projects on the Platte and Niobrara Rivers, which have been under consideration for some time, at least one of the interurbans wanted by the Commercial Club will be a reality, according to a statement made by C. W. Baker, of the Baker Construction Company. It is expected that work will be commenced next spring on the construction of an electric line from Norfolk to Omaha, and up the river to Sioux City, by the Nebraska Transportation Company. Bonds have been sold and only the details of securing terminals and sites for storage and power houses remain to complete the arrangements for building.

NEW YORK, N. Y.—In connection with the recent new development of the plans of the Norwich, Colchester & Hartford Traction Company, which has a charter giving it the right to build a trolley line from East Hartford to Norwich, the MacArthur Brothers' Company, of this city, is credited with the announcement that they have entered into a preliminary contract with the projectors of the Norwich, Colchester & Hartford Traction Company looking to the building, equipping and operation of the proposed line. Certain mutual undertakings are involved, which, upon their conclusion, will finally give to the residents of Norwich, Hartford and intervening towns a much needed avenue of communication. The experts have fully investigated the matter, and questions as to the cost of construction and the results of operation have practically all been satisfactorily settled.

PROPOSALS.

PORCELAIN RECEPTACLES.—Sealed proposals will be received by the Navy Department, Bureau of Supplies and Accounts, Washington, D. C., until December 3 for 4,000 porcelain receptacles to be delivered at the Navy Yard, Brooklyn, N. Y., as per Schedule 4954.

ELECTRICAL WORK.—Some attractive contracts for electric work in the new court house at Akron, O., will be let about December 1, for a thoroughly modern building to be erected there to take the place of the one destroyed by fire recently. Vernon Redding, of Mansfield, O., is the architect.

ELECTRIC FANS, ETC.—Sealed proposals will be received by the Navy Department, Bureau of Supplies and Accounts, Washington, D. C., until November 26 for 18 electric ceiling fans and other electrical supplies to be delivered at the Navy Yard, Norfolk, Va., in accordance with Schedule 4944.

RELOCATION OF PASSENGER ELEVATOR.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until December 4 for the relocation, etc., of the electric passenger elevator in connection with the extension to the post office at Raleigh, N. C., in accordance with drawing and specification, copies of which may be obtained from the Supervising Architect.

ELECTRIC CONDUIT AND WIRING AND INTERIOR LIGHTING FIXTURES.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until November 17 for the electric conduit and wiring and interior lighting fixtures of a one-story building for the post office at Lorain, O., in accordance with plans and specifications, which

may be obtained from the office of the Supervising Architect.

ELECTRICAL EQUIPMENT.—Sealed proposals will be received at the office of the City Clerk, Fairfield, Ill., until November 29, 1912, for furnishing material and installing water works and electrical improvements as follows:

An addition to municipal power house.

1—150-horsepower return tubular 150-pound-pressure steam boiler, with stack and all connections.

1—150-kilovolt-ampere three-phase, 60-cycle, 2,300-volt alternating-current belt-driven generator with belted exciter.

1—Two-panel marble switchboard with all necessary meters, switches, etc.

1—15-kilowatt 60-cycle, 2,300-volt tungsten series street light regulator.

1—60,000-gallon steel tank on 100-foot steel tower.

1—450-gallon-per-minute motor-driven turbine pump.

1—Steam-driven air compressor with a capacity of 125 cubic feet of free air displacement per minute.

1—Air receiver 3 feet by 6 feet.

1—20,000-gallon concrete reservoir

All piping for connecting air receiver to wells, wells to reservoir, reservoir to pump, pump to elevated tank, and tank to distributing system.

53—Three-light tungsten street-light hoods, with porcelain-enamel reflectors 22 inches in diameter, f. o. b. cars Fairfield.

60—100-candlepower and 100 60-candlepower. 5.5-ampere series tungsten lamps, f. o. b. Fairfield.

Plans and specifications may be obtained from the city clerk, or the engineers, Fuller-Coult Company, Chemical Building, St. Louis, Mo.

FINANCIAL NOTES.

The Mexico Tramways Company will issue $3,500,000 of additional common stock at par. The issue will bring the total amount up to the full amount of the $20,000,000 authorized. The stock is being offered to shareholders on a basis of seven thirty-thirds of a share of new stock for every share of old stock held.

All but two per cent of the Illinois Northern Utilities Company has been taken over by the Middle West Utilities Company on a basis of $15 in preferred and $13.33 in common stock of the Middle West Utilities Company for each share of Illinois Northern common stock. Both are Insull companies, Mr. Insull being principal holder of the common stock in both companies.

Boston Elevated stockholders have formally approved an issue of not exceeding $5,000,000 bonds. Bonds are to be payable in not more than thirty years, and actual maturity and rate of interest are to be determined by the executive committee. The $4,000,000 stock issue was also approved. Authorization of issue of 40,000 shares of stock to present Boston Elevated stockholders at $105 per share should mean rights of between $2.50 and $3 per share. Presen capital stock of Boston Elevated is $19,950,000.

At a meeting of the directors of the Portland (Ore.) Railway, Light & Power Company, resolutions were adopted calling for an assessment of five per cent, or $5 a share, on the stock of the company from the shareholders of record on November 16, the assessment to be paid December 2. A resolution was also adopted providing for a special dividend of $5 a share, not to be paid in cash but to be credited to stockholders at the time of the payment of the five-per-cent cash assessment on December 2 as an additional payment on account of the amount remaining unpaid upon their stock, making it seventy-five per cent paid. The assessment will provide $1,250,000 for extensions, betterments, etc., and is in accordance with an agreement made with the bankers who purchased the $16,000,000 first and refunding bonds of the company last February.

A special meeting of the stockholders of the Kings County Electric Light & Power Company will be held on November 26 at 11 a. m. at its office, 360 Pearl Street, Brooklyn, N. Y., for the purpose of acting upon the recommendation of the Board of Directors to issue $5,000,000 in par value of convertible six-per-cent debenture bonds. The books of the company remain closed until November 27.

The Wisconsin Edison Company, a $12,000,000 holding corporation has been incorporated at Albany in behalf of the North American Company, by Henry H. Pierce, Frederick H. Fiske, Edward H. Green, John Furster Dales, and John H. Ryan, who paid a tax of $15,000 to the State. Of the authorized capital, $10,000,000 consists of six-per-cent cumulative preferred stock, and there are 200,000 shares of common stock with no stated par value. The new company has been formed to take over the holdings of the North American Company and the public utilities which it controls within the State of Wisconsin. It will own the capital stock of the Milwaukee Light, Heat & Traction Company, which, in turn, owns the Milwaukee Electric Railway & Light Company, the Wisconsin Gas & Electric Company, the Watertown Gas & Electric Company, the North Milwaukee Light & Power Company, the Burlington Light & Power Company, and the common stock of the Milwaukee Electric Railway & Light Company, which was issued for the acquisition of the Milwaukee Central Heating Company.

Dividends.

Federal Light & Traction Company; a regular quarterly dividend of 1.5 per cent on the preferred stock, payable December 3, to stock of record November 15.

Federal Utilities, Inc., the regular quarterly dividend of 1.5 per cent, payable December 2 to stock of record, November 15.

Kings County Electric Light & Power Company; the regular quarterly dividend of two per cent, payable to stock of record November 20.

Portland Railway, Light & Power Company; a quarterly dividend of $1.25 per share, payable December 2 to stock of record November 16; an increase of twenty-five cents per share.

Reports of Earnings.

METROPOLITAN WEST SIDE ELEVATED.

The Metropolitan West Side Elevated Railroad Company reports for the year ended June 30, 1912, compared as follows:

	1912	1911
Gross	$2,991,180	$3,026,864
Expenses	1,396,981	1,544,125
Net	1,594,199	1,482,739

The surplus for the year ended June 30, 1912, after deducting charges, depreciation, dividends, etc., was $118,292, as compared with $145,126 the previous year.

SOUTH SIDE ELEVATED.

The report of the South Side Elevated Railroad Company for the year ended June 30, 1912, compares as follows:

	1912	1911
Gross	$2,464,020	$2,446,236
Expenses	1,105,569	1,490,336
Net	1,358,451	955,900

The surplus for the year ended June 30, 1912 after charges, depreciation and dividends was $96,090 as compared with $.24,551 the previous year.

NORTHWESTERN ELEVATED.

The Northwestern Elevated Railroad Company has issued its report for the year ended June 30, 1912. The income account compares as follows:

	1912	1911
Gross	$3,177,215	$2,776,905
Expenses	1,314,394	1,069,476
Net	1,862,821	1,707,429
Charges, taxes, etc.	1,745,066	1,269,920
Surplus	177,755	437,509
Preferred dividends	98,888	200,000
Surplus	18,867	237,509
Earnings on $5,000,000 preferred stock	2.3%	8.7%

NEW YORK RAILWAYS REPORT.

The New York Railways Company reports for September and three months ended September 30, 1912, as follows:

	September 1912	July 1 to Sept. 30
Gross	$1,169,395	$3,485,464
Net after taxes	462,896	1,251,395
Other income	34,868	100,310
Total income	497,764	1,351,705
Interest on underlying bonds	224,746	674,226
Interest on refunding 4s	54,331	162,992
Total interest	279,077	837,217
Balance	218,687	514,488

Passengers carried September, 1912, 22,569,724. For the three months ended Sept. 30, 67,247,925 passengers were carried.

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	Nov. 11.	Nov. 4.
American Tel. & Tel. (New York)	143	142¼
Commonwealth Edison (Chicago)	144	145
Edison Electric Illuminating Boston)	280	274¼
Electric Company of America (Philadelphia	*12¼	*12¼
Electric Storage Battery common (Philadelphia)	56¼	54
Electric Storage Battery preferred Philadelphia)	56¼	54
General Electric (New York)	181¾	180⅛
Kings County Electric (New York)	129	129
Manhattan Transit (New York)	1½	1¾
Massachusetts Electric common (Boston)	18	19½
Massachusetts Electric preferred stamped (Boston)	77	77
National Carbon common (Chicago)	126	126
National Carbon preferred (Chicago)	118½	120
New England Telephone (Boston)	155	153
Philadelphia Electric (Philadelphia)	24⅛	22⅝
Postal Telegraph and Cables common (New York)	86¼	83½
Postal Telegraph and Cables preferred (New York)	68	67½
Western Union (New York)	78¾	78
Westinghouse common (New York)	82	81¾
Westinghouse preferred (New York)	122	*122½

*Last price quoted.

PERSONAL MENTION.

GEORGE C. REINOEHL, of Pittsburgh, Pa., has been appointed division manager of the Bell Telephone Company, with headquarters in Harrisburg, Pa.

GARRISON GRAWOIG read an interesting paper before the Byllesby Luncheon Club on November 6, upon the subject, "Public Utility Commissions."

A. J. ANDERSON, president of A. J. Anderson & Company and one of the best known electrical contractors in Louisville, Ky., has returned from a business trip covering Kentucky.

R. F. PACK, general manager of the Minneapolis General Electric Company, has been appointed a member of the Smoke Prevention Committee of the Minneapolis Civic & Commerce Association.

ERNEST VAN ARSDEL, general manager of the Shelbyville Water & Light Company, of Shelbyville, Ky., has purchased a site for a handsome new residence which he is to erect in Shelbyville.

HERBERT HICKLING, superintendent of the Jamesburg (N. J.) Electric Company, has resigned to accept the superintendency of the Motor Department of the Baldwin Locomotive Works, Eddystone, Pa.

HENRY C. DARLING, of the Chattanooga Railway & Light Company, of Chattanooga, Tenn., and Miss Helen Louise Miller, one of the prettiest and most attractive girls of Carrollton, Ky., were recently married in Kansas City, Mo.

F. H. TIDNAM, second vice-president of the Oklahoma Gas & Electric Company, addressed the engineering students of the State University at Norman, Okla., on October 27, his subject being "Electrical Engineering as a Profession." His talk was well received.

EUGENE CREED has resigned as sales manager of the Morris Iron Company to accept a position as new-business manager of the Lexington Utilities Company, Lexington, Ky. He was formerly sales manager of the Toronto Electric Light Company and returns to similar work with renewed energy and ambition.

J. W. COOKE, electrical engineer of the Electric Storage Battery Company of Philadelphia, spoke before the classes of the Boston Y. M. C. A. Automobile School, November 13, on "The Use and Care of Storage Batteries for Electric Lighting and Ignition Work for Gasoline Automobiles." The lecture was illustrated by stereopticon slides showing storage batteries in operation, both charging and discharging.

HARRY B. SEWALL, who for the last three years has been general manager of the Paducah Light & Power Company and the Paducah Traction Company, of Paducah, Ky., both Stone & Webster properties, is to become general manager of the Stone & Webster utilities in Dallas, Tex., at once. W. L. Weston, who has had charge of various utilities in Florida and Texas during the past few years, has been appointed to succeed Mr. Sewall in Western Kentucky.

B. F. EYER, who founded the department of electrical engineering in the Kansas State Agricultural College in 1900, has resigned and will enter commercial life, January 1. Professor Eyer was a teacher of physics and chemistry in the Topeka High School for five years and was vice-principal in that school when he resigned to go to the Kansas State College. Previously he had been head of the physics department of the Hiawatha Academy at Hiawatha, Kans. He is a member of the American Institute of Electrical Engineers, the National Electric Light Association, a past-president of the Kansas Gas, Water, Electric Light and Street Railway Association, and holds the degree of electrical engineer, conferred upon him in 1908.

NEW PUBLICATIONS.

MAGNETIC OBSERVATIONS IN ALASKA.—The United States Coast and Geodetic Survey has issued a report of observations made at the magnetic observatory at Sitka, Alaska, in 1909 and 1910, by Daniel L. Hazard. The instruments used in this work are mentioned and their constants given. Observations of the hourly value of declination, horizontal and vertical intensity are given, with a summary of monthly and annual means. The diurnal variation of declination and horizontal intensity are tabulated. A record of earthquakes and magnetic storms is included and reproductions are given of magnetograms showing the principal magnetic storms during these two years.

REPORT OF DEPARTMENT OF MINES.—The summary report of the Mines Branch of the Department of Mines, Ottawa, Canada, for the year 1911 has been issued. It contains the report of the director general and account of the field work relating to iron, copper, nickel, phosphates, building stones, gypsum and salt; the reports on chemical laboratories, statistical division, assay office, fuel-testing station, metallurgical laboratory, etc.; and a list of publications issued during the year. There are also three papers by Edgar Stansfield on the determination of moisture in fuels, tests of pyrene and an electricallly heated furnace for organic analysis. Two appendices contain reports on the mineral production of Canada for the year and on explosives.

NEW INCORPORATIONS.

POTEET, TEX.—The Poteet Ice, Light & Water Company has been incorporated with capital stock of $10,000. The incorporators are J. L. Burd, C. J. Ernst and Van H. Howard, all of San Antonio, Tex. Z.

BOSTON, MASS.—The Anderson Electric Car Company has been incorporated with a capital stock of $10,000. Albert Weatherby, Frank R. Keith and Alonzo E. Yont are named as the incorporators. W.

SEATTLE, WASH.—Western Dry Battery Company, Incorporated, has been granted a charter with a capital stock of $20,000. James Bennett and Roy V. Bennett are named among the incorporators.

CHICAGO, ILL.—The National Electric Company has been incorporated with a capital stock of $2,500 to manufacture and deal in electrical devices. The incorporators are C. Russell Clapp, John E. Lake and Ralph E. Church. Z.

QUINCY, ILL.—The Quincy Electric Supply Company has been incorporated with a capital stock of $6,000, to do a general electric supply business. The incorporators are F. L. Havermale, Frank J. Penick and J. M. Winters. Z.

AKRON, O.—The Kittelberger Electric Company has been incorporated with a capital stock of $10,000 to deal in electrical apparatus. John Blaine Kittleberger, Frederic William Fuchs, Fred W. Fuchs and M. E. Wolf are the incorporators.

CHICAGO, ILL.—The Bland Electric Garage Company has been incorporated with capital stock of $1,500, to manufacture and deal in automobiles, electric machinery, etc. The incorporators are Robert Bland, F. B. McClaughry and L. B. Norton. Z.

CHICAGO, ILL.—The Automatic Electric Sign Company has been incorporated with a capital stock of $50,000 to engage in a printing and advertising business. M. M. Franey, Harry P. Munns and Albert Miller are named as the incorporators.

NEW YORK, N. Y.—The Wisconsin Edison Company, Incorporated, has been granted a charter with a capital stock of $12,000,000 for the purpose of dealing in electrical goods. The incorporators are Henry H. Pierce, Frederick H. Piske and Edward H. Green, all of the city of New York.

NEW YORK, N. Y.—National Electric Utilities Corporation has been incorporated with a capital stock of $100,000 to deal in all kinds of electric apparatus. The incorporators are William B. Rise, New Rochelle; Arthur J. Fletcher, Newark, N. J., and George F. Barney, of New York City.

NEW YORK, N. Y.—Mannesmann Light Company of America, Incorporated, has been granted a charter with a capital stock of $10,000. This company will deal in electric lamps, etc. The incorporators are Paul Puttmann, William Domnich, New York City, and Otto Schaefer, of Cologne, Germany.

NEW YORK, N. Y.—Detecta Phone Company of America, Incorporated, has been granted a charter to manufacture and sell all kinds of electrical machinery. The capital stock is $250,000 and the incorporators are Guenther R. Pruesse, New York City; John H. Smith and William F. C. Kloepfer, of Brooklyn.

DATES AHEAD.

Ohio Society of Mechanical, Electrical and Steam Engineers. Eleventh annual meeting, Akron, O., November 21-23.

American Mining Congress. Fifteenth annual meeting. Spokane, Wash., November 25-28.

American Physical Society. Chicago, Ill., November 30.

American Society of Mechanical Engineers. Annual meeting, New York, N. Y., December 3-6.

American Institute of Chemical Engineers. Annual meeting, Detroit, Mich., December 4-6.

American Association for Advancement of Science and affiliated societies. Annual meeting, Cleveland, O., December 30-January 4, 1913.

Electrical Contractors' Association of New York State. Annual meeting, Syracuse, N. Y., January 21, 1913.

Western Association of Electrical Inspectors. Annual meeting, St. Louis, Mo., January 28-30, 1913.

National District Heating Association. Fifth annual convention, Indianapolis, Ind., May 27-29, 1913.

With the Electrical Manufacturers

Sanford E. Thompson, consulting engineer, Newton Highlands, Mass., announces the establishment of Boston offices at 141 Milk Street. The main offices and laboratories will still be maintained at Newton Highlands.

National X-Ray Reflector Company, 235 West Jackson Boulevard, Chicago, Ill., is sending to the trade leaflets calling attention to the advantages of the Scoop window reflector. These are arranged so that the imprint of the local dealer can be added, thus making a valuable means of stimulating the proper illumination of show windows.

Maschinenfabrik Oerlikon, Oerlikon, Switzerland, has published a bulletin describing its portable electrohydraulic riveting machines. Several types of these machines are illustrated and described. These machines are capable of developing as much as eighty-tons pressure. They are made for mounting in horizontal or vertical position.

The Mesta Machine Company, Pittsburgh, Pa., has received an order from the Alpha Portland Cement Company, Cementon, N. Y., for three gas engines, direct-connected to 600-kilowatt alternating-current generators. These engines are to operate on producer gas and will furnish power to the new extension of the Alpha plant, which will double its present capacity.

The Morris Iron Company, through its western agent, A. M. Ryckoff, 257 Monadnock Block, Chicago, Ill., has recently sold posts for street lighting in East Chicago and Indiana Harbor, Ind., totaling 215; Hobart, Ind., 66; Dubuque, Iowa, 25; La Grange, Ill., 25; Chicago, Ill. (Belmont Avenue), 40. Mr. Ryckoff also does installation work and a portion of the above orders were installed by him.

The Enterprise Electric Fixture & Construction Companies, 6509 Euclid Avenue, Cleveland, Ohio, have issued an attractive booklet entitled "The Light Artistic." It calls attention to the various requirements of illumination in the home, and to the large equipment of modern artistic fixtures that are on exhibition in the headquarters of this organization. Reference is also made to its excellent facilities for electric wiring work in both new and old residences.

Queen-Gray Company, 618 Chestnut Street, Philadelphia, Pa., has purchased the business of Queen & Company, Incorporated, and will continue business in engineering, electrical and scientific instruments. The new company, of which J. G. Gray is president, is taking over the machinery, stock in trade, patents, good will and assets of the old concern, including all accounts subsequent to October 15. Mr. Gray was for many years president of the old company, and the personnel otherwise remains the same.

Leeds & Northrup Company, 4901 Stenton Avenue, Philadelphia, Pa., has issued catalog No. 60, which deals with the Reichsanstalt precision photometer and accessories. These photometer outfits are used in the leading laboratories of the country. Included in the equipment is the photometric track, an observing carriage, an end carriage, one or more photometric screens, lamp sockets, compound rotator, rotating sector, rheostats, etc. A simple form of station photometer for work of high accuracy is also described. Reference is also made to the Leeds & Northrup and the Brooks potentiometers, which are largely used in connection with voltage determination in incandescent-lamp tests.

Platt Iron Works Company, Dayton, O., has been completely reorganized, the new company taking over all the physical assets and accounts of the old company. It starts free of all floating indebtedness, with a working capital of $700,000, which is represented by six-per-cent 20-year gold bonds. The capitalization also includes $1,100,000 of preferred stock and $1,000,000 common stock. The new chairman of the board of directors is Waddill Catchings, of the Central Foundry Company, New York City. J. B. Reichman has been made president and John Sturgess, secretary. The entire organization has been kept intact. The improvements are now under construction and will increase the capacity of the plant and facilitate the handling of orders. No effort will be spared to bring the company's products to the highest standard of efficiency and it is in a favorable position to serve its patrons.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., reports that among the many recent orders received by it were the following: The British Columbia Electric Railway Company, Vancouver, B. C., for five 50-ton locomotives, each to be equipped with four No. 308B-3 motors and type HB control; Pittsburgh Railways Company, Pittsburgh, Pa., for two motor-generator sets each consisting of a 1,000-kilowatt, 550-volt, compound direct-current generator and one 1,440-horsepower, three-phase, 60-cycle, 10,000-volt, synchronous motor, also three 250-kilowatt, 22,000-volt transformers and complete switchboards for four substations, together with auxiliary apparatus for this equipment; Kansas City Electric Light Company, Kansas City, Mo., for two frequency-changer sets which consist of a 1,250-kilowatt, three-phase, 62.5 cycle, 2,400-volt generator and one 1,860 horsepower, three-phase, 25-cycle, 6,600-volt synchronous motor; Tri-State Railway & Electric Company, East Liverpool, O., for one 4,000-kilowatt, 2,400-volt, two-phase, 60-cycle turbogenerator together with exciter, rotary converter, transformer and switch and control apparatus for the above equipment; Pacific Gas & Electric Company, San Francisco, Cal., for four 12,500-kilowatt, three-phase, 60-cycle, 6,600-volt water-wheel generators; Pacific Light & Power Company, Los Angeles, Cal., for two 17,500-kilowatt, 6,300-volt, three-phase, 50-cycle water-wheel generators—two exciter sets—a 200-kilowatt motor-generator set, including a 250-volt direct-current generator and 6,600-volt induction motor—a 15,000-kilovolt-ampere, 6,600-volt, 50-cycle synchronous condenser with direct connected exciter—24 transformers ranging up to 150,000 volts and in various sizes up to 5,000 kilowatts—all this equipment is to be used for the generating station 70 miles from Fresno, Cal., for two substations and for the transmission lines.

Record of Electrical Patents.

Issued by the United States Patent Office, November 5, 1912.

1,043,069. Recording Door-Lock. J. F. Cole, assignor to National Recording Lock Co., Portland, Me. Includes a system for sending differentiated electrical impulses to the recording mechanism according to the keys used.

1,043,074. Trajectory-Regulator for Projectiles. C. Davis, U. S. Navy. Includes electric means for controlling the centrifugal movement of plates that change the contour of the projectile cap.

1,043,089. Apparatus for Annealing Wire. W. E. Gibbs, assignor to Gibbs Co., Plainfield, N. J. The wire is electrically heated, passed through a steam tube and finally quenched in electrically warmed water.

1,043,090. Manufacture of Steel. P. Girod, Ugines, France. An electric furnace process of converting cast iron into steel.

1,043,094. Time-Recorder. H. T. Goss, Rutherford, and J. W Bryce, Bloomfield, N. J. Includes an electrically controlled mechanism.

1,043,096. Electrolytic Apparatus. W. E. Greenawalt, Denver, Colo. Cylindrical cathodes revolve between concentric rows of anodes.

1,043,101. Hydraulic Machine. A. W. Harris, Grand Mere, Que., Canada. Includes an electric indicator to show the operation of the cylinder.

1,043,103. Trolley Wheel. G. E. Henry, Vincennes, Ind. Has electrically conducting tapering bearings.

1,043,104. Method of Electrical Distribution. P. C. Hewitt, assignor to Cooper Hewitt Electric Co., New York, N. Y. A number of interrelated oscillatory circuits are charged successively and discharged successively.

1,043,110. Combined Switch and Starting Device. A. A. Kent, Philadelphia, Pa. Control for the sparking circuit and timer of an internal-combustion engine.

1,043,116. Magneto Mounting. W. S. Lee, assignor to Briggs-Detroiter Co., Detroit, Mich. A combined gear case and bracket on the engine frame near the shaft.

1,043,117. Apparatus for Producing Rapid Electric Oscillations. E. von Lepel, Berlin, Germany. Includes means for limiting the active surface of two parallel plates forming the spark gap.

1,043,127. Apparatus for Carbonating Liquids. R. Mueller, Chicago, Ill. The electric motor that drives the liquid pump is automatically started and stopped.

1,043,128. Illuminated Spirit-Level. C. A. Murphy and M. W. Reynolds, Oakland, Cal. Has electric lamps inclosed to illuminate the level tubes.

1,043,150. Potential Indicating and Measuring Device. E. Schweitzer, Chicago, Ill. Includes a set of carbon pencils in series with incandescent lamps that may be cut out, one by one.

1,043,154. Electrolytic Production of Light Metals. G. O. Seward, F. von Kügelgen and F. von Bidder, assignors to Virginia Laboratory Co., New York, N. Y. The anolyte and catholyte are partly separated by a salt-incrusted curtain.

1,043,164 and 1,043,165. Conduit for High-Potential Conductors. S. D. Sprong and W. E. McCoy, New York, N. Y., assignors of one-third to F. W. Smith. The line conductors are immersed in liquid dielectric. The second patent relates to a set of traps and means for dehydrating the liquid.

1,043,170. Signaling System for Railways. L. H. Thullen, assignor to Union Switch & Signal Co., Swissvale, Pa. A block system for an alternating-current railway in which the signaling current has a different frequency from the propulsion current.

1,043,179. Plural Lamp Socket. N. Weeks, assignor to Benjamin Electric Manufacturing Co., Chicago, Ill. A cluster with the individual sockets and connections therefor molded into a single body.

1,043,207. Automatic Self-Starter for Motors. H. H. Cutler, Milwaukee, Wis. Includes a solenoid for moving the resistance-varying arm, a no-load release magnet and a switch to cut out the solenoid when the arm reaches its limit.

1,043,217. Railway-Switch Contact. E. J. Dunne, Newark, N. J. The trolley wheel bridges contact plates for a track-switch circuit.

1,043,219. Coin Collector. O. F. Forsberg, assignor to Western Electric Co. Includes electromagnetic control of the coin deflector in a telephone box.

1,043,221. Gas Engine. A. M. Gibson, Chicago, Ill. The port valve and timer for the electric sparking mutually control each other.

1,043,256. Lamp. L. Schepmoes, assignor to Safety Car Heating & Lighting Co., New York, N. Y. An electric deck lamp with dustproof reflector and diffuser.

1,043,260. Gain. B. R. Shover, Youngstown, O. A V-shaped metal gain with a flanged seat for the cross-arm and bent ends and spikes to engage the pole.

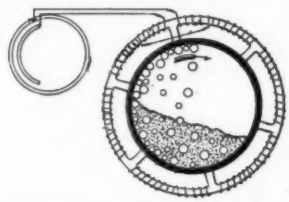
1,043,266. Lighting Fixture. C. T. Staines, assignor to Staines, Bunn & Taber Co., Brooklyn, N. Y. A semi-indirect fixture with a glass cover held by a ring between the stem and upper edge of bowl.

1,043,268. Electric-Lamp Controller. A. C. Stanbrough and E. Johnson, Newberg, Oreg. A plug socket with regulating resistance operated by pull cords.

1,043,272. Tuning Device for Wireless Telegraphy and Telephony. W. E. D. Stokes, Jr., and G. W. Davis, assignors to W. E. D. Stokes, New York, N. Y. The number of turns on the primary and secondary can be adjusted and the coils can be adjustably telescoped.

1,043,274. Attachment for Spark Coils. C. H. Thordarson, Chicago, Ill. The coil casing carries a detachable circuit-breaking vibrator.

1,043,299 to 1,043,301. Telephone System. H. P. Clausen, assignor to Stromberg-Carlson Telephone Manufacturing Co., Rochester, N. Y. Relate



1,043,349.—Electromagnetic Ball Mill.

to various features of the switchboard operators' cord circuits.

1,043,306. Trunking Telephone System. A. H. Dyson, assignor to Stromberg-Carlson Telephone Manufacturing Co. Provides special relay control for the lamp signals.

1,043,307. Switching Key. E. G. Eidam, assignor to Stromberg-Carlson Telephone Manufacturing Co. Covers details of construction of telephone-switchboard keys.

1,043,314. Telephone System. C. L. Goodrum, assignor to Stromberg-Carlson Telephone Manufacturing Co. Relates to the control of the line and supervisory lamps.

1,043,318. Electrical Checker-Board. R. C. Jackson, Dayton, O. Each checker space consists of two sections over which a metal checker may be placed to close an indicator circuit.

1,043,320. Reciprocating Motor. W. H. Keller and S. D. Sibley, Connellsville, Pa., assignors to Keller-Sibley Electric Drill Co. An electromagnet reciprocates the shaft by attracting an inclined rotating disk.

1,043,321. Combined Insulator and Current-Distributer. E. H. Knutz, Arcata, Cal. Has inclined radial arms to which the distributing wires are connected.

1,043,325. Variable-speed Electric Motor. J. C. Lincoln, assignor to Lincoln Co., Cleveland, O. The fields have shunt coils and series starting coils; the commutator has stationary and rotating brushes.

1,043,328. Electrolyte. W. H. Lowe, assignor to Float Electric Co., Ltd., New Kent Road, England. Contains sodium bichromate, sulphuric acid, salt and water.

1,043,332. Multiple Cash-Recorder. P. A. McCaskey, Alliance, O. Has electrical drawer release, lamp signals and recording mechanism.

1,043,340. Electric Controller. J. A. Moore, Chicago, Ill. A spindle carries an oscillatory controlling member and segmental switch adapted to engage various contacts.

1,043,349. Ball Mill. H. Ostwald, Cologne, Germany. A rotatable drum containing iron balls has electromagnets surrounding its circumference that carry the balls up to the highest point.

1,043,380. Lamp Socket. H. C. Wirt, Plymouth, Mass., and F. W. Sanford, Chicago, Ill. Relates to the means for connecting the cap and shell.

1,043,382. Thermostat. L. W. Zettler, Louisville, Ky. Circuit terminal plates are arranged in a chamber with an adjustable contact screw between them.

1,043,410. Striking Mechanism for Typewriters. P. J. Dreher, Toledo, O. Has an electric driving means for the sheet.

1,043,449. Electric Telegraphic Apparatus. H. G. Martin, East Rutherford, N. J. An operator's key and vibrator.

1,043,467. Boot-Leg for Track Circuits. F. W. Rutledge and E. E. Ireland, Elk River, Minn. A metallic shield protects the electrical connection and is secured to the foot of the rail.

1,043,471. Railway Signal. J. A. Shaw, Rimersburg, Pa. Includes an electromagnetic controlling device.

1,043,475. Stone-Cutting Saw. J. J. Smith, New York, N. Y. Coils on each side of the saw make it one pole of a magnetic circuit, of which the other pole is an iron plate on a stone-carrying car.

1,043,481. Method and Apparatus for Producing and Feeding Furnace Electrodes. E. R. Taylor, Penn Yan, N. Y. The electrode is continually fed in layers into a longitudinal sectional mold.

1,043,487. Electrically Heated Utensil. A. A. Warner, assignor to Landers, Frary & Clark, New Britain, Conn. The heating unit is specially mounted in the hollow base.

1,043,526. Telephone. R. H. Lindal, Gloucester City, N. J. A vessel and its tow are connected by a telephone line spirally arranged in the towing hawser.

1,043,527. Magnetic Traction Apparatus. D. L. Lindquist, assignor to Otis Elevator Co., Jersey City, N. J. An elevator sheave is composed of iron and non-magnetic sections and contains energizing coils.

1,043,528. Brake-Magnet Protective and Demagnetizing Device, D. L. Lindquist, assignor to Otis Elevator Co. The electric brake for an induction elevator motor is connected in parallel with it.

1,043,530. Lamp-Supporting Device. R. M. Millar, Chicago, Ill. A spiral spring coil terminates in a holder that grasps the socket.

1,043,532. Contact-Switch Equipment. J. R. Nestor, Seattle, Wash., assignor to Automatic Announcer Co. A street or station indicator is electrically operated when part of the trol-

ley or contact shoe engages special contacts along the trolley wire or third rail.

1,043,535. Secondary Storage Battery. O. Oldham, Denton, England. A gas-collecting cap in the cover is connected through a tube with a gas exit at the bottom of the cell.

1,043,553. Heating Apparatus. N. B. Wales, assignor to G. B. Collier, Kinderhook, N. Y. A thermostat controls the starting, speed and stopping of an electric motor that drives the pumps.

1,043,557. Illuminated Flower-Holder. L. W. Young, New York, N. Y. Electric lamps are concealed in the translucent lower part of the stand.

1,043,561. Test-Tube Heater. J. I. Ayer, assignor to Simplex Electric Heating Co., Cambridge, Mass. A slab with parallel ridge-like pockets for the tubes has an electric heating element at the back.

1,043,562. Periscope with Compass Attachment. C. H. Bedell, assignor to Electric Boat Co., New York, N. Y. Includes electric illumination of the compass.

1,043,565. Current-Controller. L. Bradley, assignor to Allen-Bradley Co., Milwaukee, Wis. Includes a compressible resistor and pressure-varying means compensating for changes in temperature in the resistor.

1,043,573. Reciprocating Motor. W. H. Keller and S. D. Sibley, Eccles, W. Va., assignors to Keller-Sibley Electric Drill Co. A modification of No.

1,043,561.—Test-Tube Heater.

1,043,320 in which there are two inclined disks on the drill shaft.

1,043,574. Railway Vehicle with Electromagnetic Adherence and Shiftable Axles. A. Ehrlich, Budapest, Austria-Hungary. The rotation of the front and rear wheels is alternately checked and during this interval the respective wheels are energized to attract the rails, the axles shifting a limited amount.

1,043,615. Switchboard. W. J. Magee, assignor to Southern Stamping & Die Works, New Orleans, La. Includes insulated sectionalized busbars connected together by end pins.

1,043,616. Automatic Draft-Modifier. C. O. Mailloux and H. J. Westover, New York, N. Y. Is driven by an electric motor which is controlled by a rotary switch that in turn is operated by an electric timing motor.

1,043,633. Means for Assembling and Disassembling Electric Motors. F. L. Sessions, Columbus, O., assignor to Jeffrey Manufacturing Co. Armature and field can be simultaneously raised and lowered through a lifting yoke that engages the fields and a sling that supports the armature.

1,043,637. Circuit-Breaker. H. L. Smith, assignor to Clinton Wire Cloth Co., Boston, Mass. One jaw of a welding machine has contacts adapted to break the circuit on completion of the "upset."

1,043,640. Automatic Electric Excavating Bucket. W. G. Stephan, Cleveland, and C. E. Beard, Columbiana, O. Is operated by an electric motor that is automatically controlled through a reversing switch.

1,043,655. Actuating Device for Circuit-Closers. G. D. Young, Hereford, Tex. De-energization of an electromagnet releases an armature that actuates the circuit-closers.

1,043,663. Electrically Driven Clock. P. A. Bentley, Burton-upon-Trent, England. Has an electromagnetically actuated pendulum.

1,043,703. Signaling Horn. M. R. Hutchison, Bronxville, N. Y. Has two electromagnetically operated vibrators.

1,043,704. Combination Alarm Device. M. R. Hutchison, New York, N. Y. An automobile horn with an electrically actuated diaphragm and a bulb actuated trumpet.

1,043,713. Wire Hanger. J. Meute, Jr., Moon Run, Pa. A flexible trolley hanger for mine railways.

1,043,718. Electric Switch. J. G. Peterson, Hartford, Conn. Covers details of a push-button flush wall switch.

1,043,719. Electric Ignition Device for Small Arms. G. Peuble, St. Etienne, France. A breech forms one terminal and a movable contact pin with an incandescing filament the other.

1,043,741. Lubricating Wheel. L. J. Tetlow, West Springfield, Mass. A trolley wheel has an annular lubricating chamber in its hub.

1,043,751. Automatic Regulator. R. S. Blair, New York, N. Y. An electric car has an inertia-actuated regulator for the motor-control circuits.

1,043,755. Circuit-Closer. H. P. Christianson, Oakland, Cal., assignor one-half to A. J. Hanford. A pair of contact-carrying arms is adapted to be held between the teeth of a person.

1,043,759. Connecting Device for Electric Conductors. D. T. Fisher, Columbus, O., assignor to Jeffrey Manufacturing Co. A cylindrical flame proof casing with spring plug-receiver in the enter.

1,043,765. Bulletin Board. A. M. Henry, assignor to M. C. Baker, Stamford, Conn. A baseball indicator with electric lamps to indicate balls and strikes and to show the progress of the game.

1,043,766. System of Electrical Distribution. P. C. Hewitt, assignor to Cooper Hewitt Electric Co., New York, N. Y. A modification of No. 1,043,104.

1,043,777. Means for Control of Electric Energy. H. W. Leonard, Bronxville, N. Y. A multi-voltage motor-control system for securing a wide range of motor speeds.

1,043,778. Electric Control System. H. W. Leonard, Bronxville, N. Y. An amplification of the above in which several motors are provided for driving a common load.

1,043,787. Reflector for Artificial Lights. O. A. Mygatt, New York, N. Y. A bowl-shaped prismatic glass reflector.

1,043,788. Thread Carrier. A. Petersen, assignor to Boston Machinery Co., Boston, Mass. Includes an electric broken-thread detector and alarm.

Patents That Have Expired.

Following is a list of electrical patents (issued by the United States Patent office) that expired November 12, 1912.

549,485. Electric Locomotive. F. B. Badt, Chicago, Ill.

549,491. Railway Telephone System. W. H. Clewley, Providence, R. I.

549,501. Electric Shunting Device. A. B. Depuy, Camden, N. J.

549,502. Dynamo Brush. J. Dickson and R. G. Shapcott, London, Eng.

549,522. Electric Motor System and Traction Device. T. I. Milligan, South Orange, N. J.

549,542. Electric Elevator. H. R. Smith, Chicago, Ill.

549,556. Automatic Electric Cutoff. C. E. Whitney, New York, N. Y.

549,577. Arc-Lamp Globe-Holder. G. L. Moyer, Hartford, Conn.

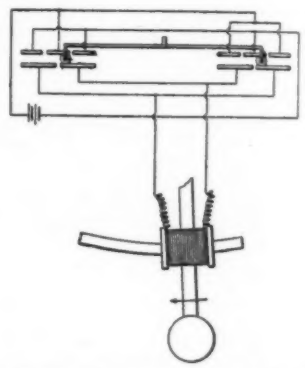
549,580. Conduit Electric-Railway System. B. E. Osborn, Auburn, N. Y.

549,597. Combined Rheostat and Reversing Switch for Electric Motors. J. P. B. Fiske, Alliance, O.

549,598. Electric Controller. J. P. B. Fiske, Alliance, O.

549,608. Electric Controller. W. H. Morgan, Alliance, O.

549,636. Electrical Steering Gear. G. S. Grimston and A. H. Dykes, London, Eng.



1,043,663.—Electrically Driven Clock.

549,642. Friction Appliance for Electric Cars. I. W. Heysinger, Philadelphia, Pa.

549,644. Regulation of Alternating Generators. F. P. Ide, Eau Claire, Wis.

549,652. Underground Electric Propulsion. J. E. Parker, New York, N. Y.

549,655. Contact Device for Electric Railways. C. A. Philipsborn, Berlin, Germany.

549,663. Carbon-Brush Holder. G. H. White, Chicago, Ill.

549,709. Multiple Telegraphy. T. B. Dixon, Henderson, Ky.

549,715. Electric Clock System. A. Franke, Berlin, Germany.

549,724. Bracket for Incandescent Electric Lights. W. R. Hitchcock, Cornwall, Canada.

549,757. Device for Pulling Ropes Through Conduits. P. C. Volland, Baltimore, Md.

549,802 and 549,803. Telephone Transmitter. I. Lucas, Passaic, N. J.

549,810. Electric Switch. W. T. M. Mottram, Dallas, Tex.

549,860. Telephone. A. Stromberg and A. Carlson, Chicago, Ill.

549,874. Electric Speed-Regulator. C. W. Larson, Schenectady, N. Y.

549,876. Electric Motor. R. Lundell, Brooklyn, N. Y.

549,886. Electric Meter. R. O. Hood, Danvers, Mass.